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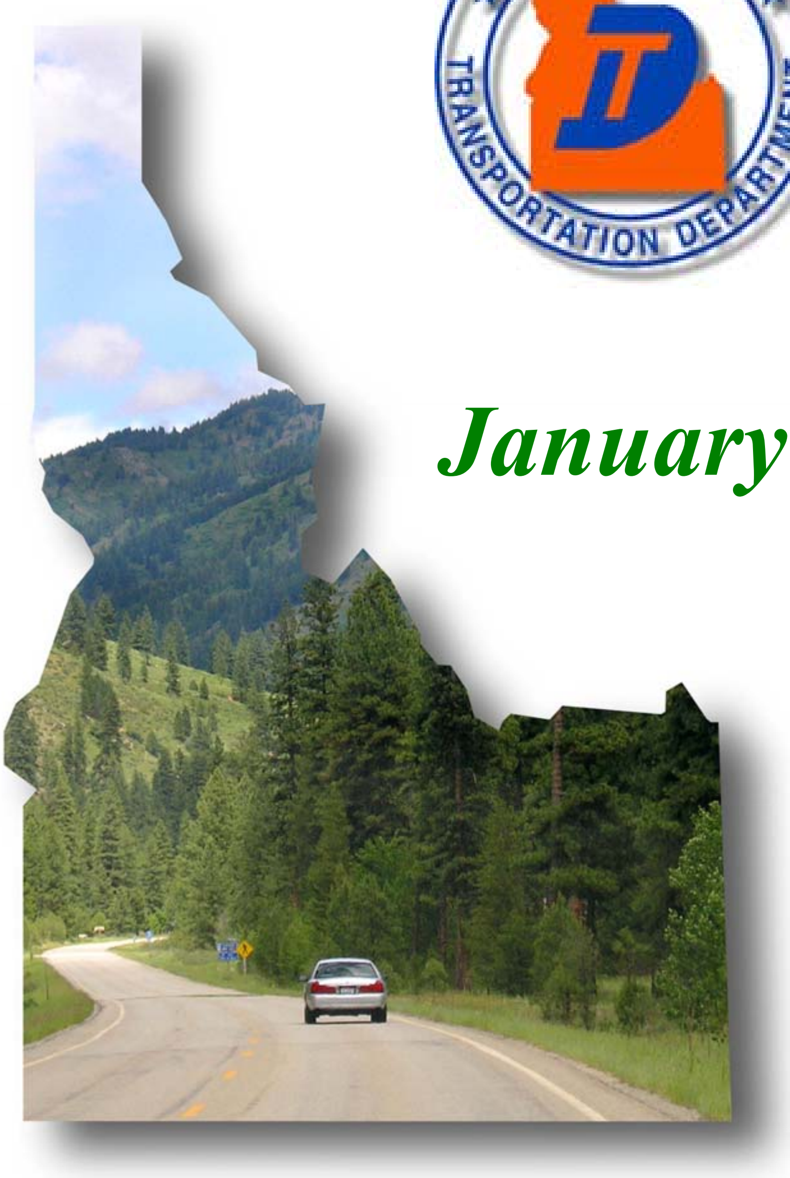
Laboratory Operations Manual



January 2014

Summary of Edition Changes – January 2014

Lab Operations Manual

1. **Section 100.00 Laboratory Operations**

    - Spelled out Federal Highway Administration

2. **Section 225.00 Concrete and Asphalt Mix Design Laboratories**

    - Capitalized Hot Mix Asphalt Pavement

3. **Section 250.10 Individual Test Method Qualifications**

    - Added AASHTO T-106 Compressive Strength of 2” Cubes using Hydraulic Cement Mortar

4. **Section 290.00 Table A-1**

    - Added ASTT II to AASHTO T-30
    - Added ASTT II to AASHTO T-166
    - Added ASTT II to AASHTO T-275
    - Added ASTT II to AASHTO T-209
    - Added ASTT II to AASHTO T-308
    - Added ASTT II to AASHTO R 47
    - Deleted SPFT and added ASTT II to AASHTO T-312

5. **Section 290.00 Table A-3**

    - Inserted Table A-3 to section

6. **Section 320.00 Soil Laboratory**

    - Deleted duplicate T-99
    - Added AASHTO M 145 to Soil Classification
    - Added AASHTO T-307 to Resilient Modulus
    - Added AASHTO T-267 Organic Content
    - Added ASTM D2434 Soil Permeability

7. **Section 330.03 Geotechnical Tests**

- Added ASTM D5731 Rock Point
- Deleted Puncture Resistance and added Puncture Strength
- Added ASTM D4595 Geotextile – Wide Width Tensile Strength
- Deleted Permeability and added Permittivity
- Deleted Open Area and added Apparent Opening Size

8. **Section 330.10 Price Reduction Schedule for Geogrids**

- Deleted Tensile Modulus and added Junction Strength

9. **Section 350.02.01 Performance Graded Binders**

- Deleted Rolling Thin Film Residue from T-315 Dynamic Shear, moved it to its own line
- Inserted after Performance Graded Binders table - Noncompliant Material and Price Adjustment: Price adjustments will be assessed on product cost, excluding freight. Determination of the price adjustment to be applied will be based on ITD Materials Laboratory testing procedures. Total price adjustments will not exceed 50% or complete rejection. The price adjustments will be based on the binder price F.O.B.
- Deleted “lot” and changed to verification unit

10. **Section 350.03 Noncompliant Material and Price Adjustment**

- Updated paragraph

11. **Section 350.04 Asphalt Price Adjustment Letters**

- Updated paragraph

SECTION 100.00 – LABORATORY OPERATIONS

SECTION 100.00 LABORATORY OPERATIONS

The Idaho Transportation Department (ITD), with approval from Federal Highway Administration (FHWA), is responsible for verifying that laboratory operations are performed in accordance with federal and state regulations for the testing of materials incorporated into highway construction projects.

In the event there appears to be a conflict between statements contained in the Laboratory Operations Manual and the current Idaho Standard Specifications for Highway Construction, the Standard Specifications will prevail.

SECTION 110.00 LABORATORY FACILITIES

ITD specifications require every laboratory to be qualified according to the ITD Laboratory Qualification Program (see Section 200.00) to perform testing for an ITD project. The Federal Code requires the HQ Central Laboratory to be accredited by AASHTO.

110.01 Testing Performed by an ITD Laboratory for Government Agencies. Laboratory testing, field testing, or inspection service is occasionally performed for another government agency. A government agency is defined as a federal, county, city, school district, or state agency**.**

Testing fees are sometimes waived; however, ITD will determine on an individual basis whether testing fees will be collected.

110.02 Testing and Inspection Performed by ITD Personnel for the Public. The ITD testing facilities are not public service laboratories. ITD cannot perform any testing or inspection services for the general public or for a commercial firm or contractor unless the material is related to a highway project or research project.

110.03 ITD Laboratory Facilities. The ITD Laboratory Facilities consist of HQ Central Laboratory and the District Laboratories.

110.03.01 HQ Central Laboratory. The purpose of the Central Laboratory is to provide testing and technical support to the ITD Division of Highways. This is accomplished through materials research and testing of products and specialized testing of construction materials for highway projects that cannot be performed in the district laboratory facilities. The Central Laboratory also performs dispute resolution testing. Each laboratory unit of the Central Laboratory is AASHTO (American Association of State Highway and Transportation Officials) accredited.

The mailing address for the Central Laboratory is:

HQ Central Laboratory
Idaho Transportation Department
3293 Jordan Street
Boise ID 83702-2151

See Section 300.00 for further description of each laboratory's function and details of the tests performed.

110.03.02 ITD District Laboratories and Field Test Facilities. Testing laboratories are located in each of ITD's districts, namely:

District 1 – Coeur d'Alene

District 2 – Lewiston

District 3 – Boise

District 4 – Shoshone

District 5 – Pocatello

District 6 – Rigby

These district laboratories may perform:

Acceptance laboratory tests, such as concrete compressive strength

Preliminary investigation tests

Independent Assurance tests

Test Strip (When Qualified)

Contractual requirements will specify the test methods to be performed by ITD laboratories.

Each district has portable field test trailers where on-site project acceptance field tests are performed for materials such as, aggregate, asphalt, and concrete.

110.04 Independent Laboratories or Qualified Laboratories. ITD specifications require a qualified and/or independent laboratory when the contractor is responsible for the sampling and testing of project materials. The non-ITD laboratories may be permanent facilities or a trailer or a building temporarily located at a project site.

110.05 Qualification of Test Laboratories. All test facilities must be qualified through the ITD Laboratory Qualification Program to test materials for ITD projects**.** **See Section 200.00.**

SECTION 120.00 MATERIALS SAMPLES

All laboratories must have policies and procedures in place to ensure that its personnel and technical staff have the ability to select, identify, handle, condition, store, and retain test samples; to ensure facilitation of timely and accurate recording of data and test reports; and to ensure the timely delivery of test reports in an acceptable format to ITD.

All samples received at HQ Central Laboratory or an ITD District Laboratory for testing must be accompanied by a completed Sample Data form. The ITD-1044 is used for all materials except as follows:

Performance graded binder, use form ITD-859

Used lube oil samples, use form ITD-945

Emulsified and all other asphalts, use form ITD-1045

It is important to complete the Sample Data form as thoroughly as possible. Many delays can be avoided when complete information is included on the form.

All of the required portion of the form must be completed.

At the time of receiving, the laboratory section supervisor checks the information on the Sample Data form for accuracy and makes necessary corrections or obtains additional information to complete the form by contacting the section submitting the material. In the unit, the sample is given a laboratory number and recorded in the log book.

At the completion of the testing, a test report will be published and distributed as explained herein. If the test report indicates the material is subject to rejection, there must be action taken to remedy the situation. The Standard Specifications, Subsection 105.03, specifies the material may be:

Accepted and allowed to remain with a price adjustment

Removed and replaced by the contractor

Corrected at the expense of the contractor

120.01 Sample Identification. ITD samples are identified by numbers followed by a letter to indicate the scope and use of the test results. The identification numbers signify specific materials and the letter signifies the type of test results.

Sample Identification Numbers

Soils	1 – 099
Quarry, Pit Run, and Crushed Gravel	101 – 199
Concrete Aggregates	201 – 299
Cement	301 – 399
Steel	401 – 499
Culvert Pipe	501 – 599
Road Mix and Plant Mix (from hot plant, roadway, etc.)	601 – 699
Joint Filler	701 – 799

Filler	801 – 899
Miscellaneous	901 – 950
Fly Ash	951 – 999
Concrete Cylinders (see below)	10001–19999
*Asphalt, Performance Graded Binders and Emulsions	2001 – 2999

*Use ITD-1045 for emulsified asphalts and ITD-859 for Performance Graded Binder.

Concrete cylinders, other than 28-day breaks, are to be marked CX, Information only, unless otherwise specified.

Class (in MPa)	Class (in 100 psi)	ID Number
20.5 or lower	30 or lower	10001-10099
24.0	35	11001-11999
27.5	40	12001-12999
27.5A	40A	13001-13999
27.5B	40B	14001-14999
27.5C	40C	15001-15999
31.0	45	16001-16999
34.5	50	17001-17500
38.0	55	17501-17999
41.5	60	18001-18500
SEAL	SEAL	18501-18999
SP*	SP*	19001-19500
SP*	SP*	19501-19999

*Use this class for concrete over 40 MPa (6,000 psi) or any class other than those listed.

Concrete cylinders will be marked as follows:

28-day tests	A, B & C
7-day tests	D & E
Any additional tests	F, G, H, I, etc.

Do not use numbers past 20000.

120.01.01 Control Samples (C)

Control samples are indicated by the letter "C." Test results for control samples are either acceptable or subject to rejection. The test results will be published on white-, buff-, or pink-colored paper. White indicates "in specification" material, whereas buff signifies near-border (NB), and pink signifies the material is outside the allowable tolerances and is "Subject to Rejection."

120.01.02 Information Only Samples (CX)

Samples indicated by the letters "CX" are tested for information only. The material may be project related or product related. The test results will always be published on white paper, whether the test results indicate the material meets or fails specifications. The near-border arrow (NB→) will indicate out-of-specification test results and the test report will be stamped "Information Only."

120.01.03 Check Samples (CK)

If the control samples' test results indicate out-of-specification material, it is possible, with the unit supervisor's concurrence, to have another sample tested for verification or retest. The check sample must be from the same lot or batch as the original sample. The check samples are treated the same as control samples for publication.

120.01.04 Preliminary Engineering Samples (P)

Some samples are taken for investigative reasons during project development. These samples are known as "P" samples, for preliminary engineering. The test results are for information only.

120.01.05 Qualification Samples (QUAL)

These samples are submitted for qualification testing to be placed on an ITD-approved products list.

120.02 Samples Received That Are Improperly Taken.

1. Receiving laboratory will log sample as usual and note “Improperly Sampled”
2. Receiving laboratory will send notification email to Sampler and Resident Engineer
    a. cc: QA Engineer, District IA Inspector
    b. cc: District IA Inspector for District samples
    c. The email will include:

“The sample of ____________ was received and noted as improperly taken because ____ ______. This sample will not be tested. Another sample must be taken as soon as possible, using the correct sampling method, and immediately sent to the lab to replace this sample. Failure to meet the minimum sampling frequency and failure to follow the correct sampling method are deficiencies that can result in actions against the individual sampler and may affect the project funding.”

3. The laboratory will complete a test report for the improper sample without any test results shown, but remarks will show the sample was not tested because it was improperly sampled.

4. Post (HQ pdf file) or distribute the test report as usual.
5. District IA Inspector, will complete a buff IA evaluation form, obtain resolution and distribute according to the usual procedures, including a copy submitted to the ITD Sampler / Tester Qualification Committee (STQC) for action.

SECTION 130.00 – LABORATORY TEST REPORTS

Test results must be published in a format that will provide all the necessary information to satisfy project contractual requirements. When a sample is tested for a specific ITD project, the project identification, sample identification, and quantity of material represented must appear with the test results on each test report. It is important that every sample tested have the test results published and made available to ITD for acceptance of the material.

130.01 Checking Mathematical Computation on Laboratory Reports.

All original computations are initialed by the person who performed them.

The Supervisor (ITD or independent laboratory) will be responsible for thoroughly checking the calculations before submitting the laboratory reports. Reports will be initialed by the "checker." If errors are found prior to publishing the test report, the test report will be returned to the originator for correcting and then rechecked. If the error is found after the test report has been published and distributed, then the procedure for correcting test reports must be followed.

The Quality Assurance Engineer or the District Materials Engineer will periodically review the calculations for ITD laboratory test reports.

130.02 Correcting Test Reports.

When correcting laboratory test reports, do not make any changes on the original test report. First, make a legible copy of the original and then make the changes on the copy. A new “Date Mailed” will be used on the corrected report. The new date will be placed below or to the right of the old date. Also indicate what was corrected by placing an arrow pointing to the correction. Electronic reports will have a comment in the “Remarks” documenting the corrections and dates. When a laboratory number is changed, note in the remarks on the test report the number that was changed.

> These same directions apply to making corrections to previously published test reports. Do not make any changes on the original laboratory report. The corrections must be made on a copy of the original report and the corrected copy is published as a separate test report with checked by box marked and initialed.

130.03 Recommendations for Price Adjustments.

The Laboratory Supervisor/QA Engineer will provide a letter of recommendation for price adjustment that will accompany any laboratory test results that are out of specification and subject to rejection. The only exception is for items where a price adjustment is not appropriate and the material must be rejected***.***

The Laboratory Supervisor or the Quality Assurance Engineer is available for any additional recommendations or information pertaining to out of specification material.

130.04 Distribution of Laboratory Test Reports.

In all cases, the original laboratory test report will be retained at the laboratory that performed the testing.

The HQ Central Laboratory and each District Laboratory will maintain the test reports in a numerical file for each year and also in the project files.

Independent laboratories or contractor's laboratories must provide copies of all test results when performing testing of materials that will be used or may be used for ITD projects. These laboratories may not provide only selected test results and will be required to verify quality control procedures that guarantee accurate testing.

- ITD District Laboratory Test Reports

District Laboratory reports will be distributed in the district only, unless HQ Central Laboratory specifically requests a copy. The exception to this policy is the Independent Assurance Reports; the distribution as shown on the forms will be followed.

- HQ Central Laboratory Test Reports

Timely distribution of the Central Laboratory reports to the districts is critical. HQ Central laboratory will notify the district person shown on the ITD-1044 Sample Data form of the results of the tests by email. The test report will be posted in the district folder on the ITD intranet for the district to view and print.

SECTION 140.00 – TESTING REQUIREMENTS FOR AGGREGATE MATERIAL SOURCES

The aggregate material in a source is evaluated for quality according to Standard Specifications, Subsection 703. The specifications for contractor-furnished sources provide that all costs will be borne by the contractor. Independent laboratories performing the testing will perform the same tests as would be conducted for ITD's own evaluation. The District Materials Engineer will determine if any specified testing may be unnecessary for specific aggregate items.

Refer to the Materials Manual, Section 270.13 – Aggregate Material Sources, and the Contract Administration Manual, Section 106.09 – Material Sources, for additional information about material sources.

SECTION 150.00 – TEST METHODS AND TEST MANUALS

The ITD Standard Specifications designate the test methods, such as AASHTO, ASTM, WAQTC, IDAHO, etc. These test methods, some of which are copyrighted, are published by the respective agencies. Testing laboratories are required to have the current versions of the test methods when performing sampling and testing.

The HQ Central Laboratory maintains an AASHTO test method website for Department personnel. See the following link: http://intranet/apps/ihs/ihs.aspx

ASTM reference standards are available on the HQ Central Laboratory web page.

ITD HQ Central Laboratory is responsible for publishing and distributing the current versions of test methods unique to ITD, which are designated in the Standard Specifications as Idaho Test Methods. The publication or revision date month/year is indicated in the bottom margin of the test method.

150.01 ITD Manuals. Following manuals can be found on the internet at http://www.itd.idaho.gov/manuals/ManualsOnline.htm

Materials Manual: Contains directions for preparing and submitting project Materials Phase reports.

Laboratory Operations Manual: Contains the ITD Laboratory Qualification Program, HQ Central Laboratory Operations and all current Idaho Test Methods – see Section 500.00.

Quality Assurance Manual: Contains the ITD Quality Assurance Program, the ITD Independent Assurance Program and Idaho Test Methods. WAQTC Methods and AASHTO Standard Methods used to test materials at the project site.

SECTION 160.00 AMRL & CCRL PROFICIENCY SAMPLES

The HQ Central Laboratory participates in the American Materials Reference Laboratories (AMRL) and Cement & Concrete Reference Laboratories (CCRL) proficiency sample program. Each of the ITD District Laboratories also participates in the AMRL program as part of the laboratory qualification requirements.

The schedule of proficiency samples is based on the testing performed by the individual District Laboratory. The District Materials Engineer will monitor the proficiency sample reports for the ITD District Laboratory to ensure reliability of laboratory testing and will maintain the report records. A copy of the district test reports and any corrective action resolutions will be sent to the ITD Quality Assurance Engineer.

FHWA receives notification from AMRL and CCRL of deficiencies of the HQ Central Laboratory. The ITD Quality Assurance Engineer will forward a copy of the corrective action to FHWA to show resolution was attained.

SECTION 200.00 – IDAHO TRANSPORTATION DEPARTMENT (ITD) LABORATORY QUALIFICATION PROGRAM

SECTION 280.00 ACCESS

SECTION 290.00 – Appendix Content

Table A-1: Test Methods & Equipment
Table A-2: Equipment, Calibration Procedures & Frequency
Table A-3: Procedure Checklist AASHTO R-18 for Quality Systems Manual

ITD-921: On-site Inspection Report
ITD-920: Laboratory Testing Equipment Inventory
ITD-922: Annual Laboratory Qualification Certificate
ITD-926: HQ Issued Laboratory Qualification Certificate
ITD-949: Individual Technician Qualification

APPENDIX B

SECTION 200.00 – IDAHO TRANSPORTATION DEPARTMENT (ITD) LABORATORY QUALIFICATION PROGRAM

The ITD Laboratory Qualification Program was developed under the guidelines of the laboratory qualification program of the Western Alliance for Quality Transportation Construction (WAQTC) and 23 CFR Part 637, Construction Inspection and Approval. This program outlines the requirements necessary for qualification of a laboratory by the ITD. To ensure that laboratories consistently provide valid test results, they must be qualified according to this program. As used in this program, the term "laboratory" means an individual test facility, fixed or mobile i.e., a trailer or building temporarily located at a project site to test materials for ITD projects is a laboratory and must be individually qualified under the program.

In all cases, an ITD annual laboratory inspection is required for qualification under this program. The program recognizes four categories of laboratories that will test materials for Idaho Transportation Department construction projects:

(1) Quality Control,

(2) Quality Assurance,

(3) Dispute Resolution and

(4) Design of Concrete and Asphalt Mixes.

Laboratories will either be owner occupied or those owned by others.

200.01 Laboratory Owner Occupied.

All 3 of the following criteria must be satisfied in order to test materials for ITD construction projects.

- The laboratory must develop and implement a quality management system such as AASHTO R 18
- Individuals performing the tests must be qualified
- Testing equipment must be calibrated

200.02 Laboratory Owned by Others.

The following criteria must be satisfied in order to test materials for ITD construction projects.

- The laboratory owner must develop and implement a quality management system such as AASHTO R 18

- Testing equipment must be calibrated by the owner

The operator is responsible for supplying qualified technicians.

200.03 Quality Management System (QMS).

This system must be developed and implemented whether it **is** for an individual laboratory or multiple laboratories owned by the same company. When multiple laboratories are owned by the same company, the quality system must include each separate laboratory and a companywide quality system. Non-calibrated, non-standardized, or broken equipment must be tagged. No testing shall be performed with non-calibrated or tagged equipment. Documentation on the disposition of all non-calibrated, non-standardized or tagged equipment shall be supplied to ITD.

200.04 AASHTO Accreditation.

Non-ITD laboratories preparing asphalt mix designs, independent assurance sampling and testing, and providing dispute resolution tests for ITD projects must be AASHTO accredited for all tests performed.

SECTION 210.00 QUALITY CONTROL LABORATORIES

Quality control of construction materials is the responsibility of the contractor and is performed during the production of the material. Quality control laboratories are those laboratories under the direct control of the Contractor. Laboratories performing quality control testing may be the following type:

- Owned and operated by the contractor
- Owned and operated by a material or product supplier
- Owned and operated by an independent testing laboratory hired by the contractor
- Owned by others and operated by the contractor

All levels of testing by the contractor or his designated laboratories to control the quality of a product are considered quality control testing. When properly verified by Quality Assurance testing, quality control test results may be used for acceptance of material when specified in the contract.

210.01 Quality Control Laboratory Inspection Duties.

ITD District Materials Engineer or their designated representative will inspect Quality Control Laboratories for those conditions necessary to perform Quality Control tests used for the acceptance of material for ITD construction projects. HQ Central Laboratory personnel are available to assist in qualifying independent testing laboratories when qualification is required for test methods the District personnel do not typically perform.

The inspection and qualification requirements for Quality Control Laboratories are outlined in Section 230.01.

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SECTION 215.00 QUALITY ASSURANCE LABORATORIES

Quality Assurance is the responsibility of ITD. Quality Assurance is planned and systematic actions that provide confidence the acceptance test results are reliable. Quality Assurance Laboratories are laboratories under the control of the ITD and generally perform one or more of the following: state acceptance testing, verification testing, and /or Independent Assurance (IA) testing, for ITD construction projects.

Quality Assurance Laboratories will generally be the following types:

- ITD Field Laboratories
- ITD District Laboratories
- ITD Central Laboratory
- A local Highway District Laboratory
- An ITD-contracted independent testing laboratory
- Owned by others and operated by ITD or its agent

215.01 Quality Assurance Laboratories Inspection Duties.

The ITD District Materials Engineer or their representative will inspect ITD field laboratories and independent testing laboratories located in Idaho in accordance with Section 230.01 for those test methods necessary to perform Quality Assurance tests of construction materials for ITD construction projects. HQ Central Laboratory personnel are available to assist in qualifying independent testing laboratories when qualification is required for test methods the District personnel do not typically perform.

If a laboratory is located in another state, qualification under the program of that state's transportation department or AASHTO accreditation may be accepted provided requirements of this program are met. Such a laboratory must furnish evidence of current qualified status for the applicable testing. The ITD annual laboratory inspection is still required. HQ Central Laboratory personnel are available to assist in qualifying out-of-state laboratories.

The inspection and qualification of ITD District Main Laboratories and Local Highway District Laboratories are detailed in Section 230.02.

Section 230.03 describes the qualification of the HQ Central Laboratory.

SECTION 220.00 DISPUTE RESOLUTION LABORATORIES

When Quality Control and Quality Assurance test results conflict and the conflict cannot be resolved, a neutral Dispute Resolution Laboratory may test the material in question. The Dispute Resolution Laboratory will be either the HQ Central Laboratory or an independent testing laboratory not currently testing on the project.

Dispute Resolution Laboratories must be AASHTO accredited for the test methods in dispute, if accreditation is offered by AASHTO for those methods. If AASHTO does not offer accreditation for the test methods in dispute, then other measures of proficiency will be reviewed. These might include other accreditation programs and/or participation in cooperative testing programs.

220.01 Dispute Resolution Laboratory Inspection Duties.

HQ Central Laboratory personnel will inspect and qualify all dispute resolution laboratories. The laboratory manager must contact ITD, Quality Assurance Engineer 60 days prior to testing dispute samples, and request inspection and qualification for those test methods where dispute resolution will be performed.

The qualification process will follow the procedures outlined in Sections 230.01.01 to 230.01.05, except the representative performing the inspection will be HQ Central laboratory personnel and the qualification will be Form ITD-926 HQ Issued Laboratory Qualification.

SECTION 225.00 CONCRETE AND ASPHALT MIX DESIGN LABORATORIES

Non-ITD laboratories must be AASHTO accredited for the test methods performed in the areas of Hot Mix Asphalt Pavement design. Non-ITD laboratories submitting new Hot Mix Asphalt and Concrete Mix Designs must be performed under the direct charge of a Professional Engineer in the State the laboratory is located.

225.01 Asphalt Mix Design Laboratory Inspection Duties.

HQ Central Laboratory personnel will inspect and qualify all Asphalt Mix design laboratories. The laboratory manager must contact ITD, Quality Assurance Engineer, and request inspection and qualification for those test methods needed to perform the mix design.

If a laboratory is located in another state, qualification under the program of that state's transportation department may be accepted provided requirements of this program are met. Such a laboratory must furnish evidence of current qualified status for the applicable testing to the Quality Assurance Engineer. In addition to the state qualification, the testing laboratory must also hold a current AASHTO qualification for the tests needed to design mixes.

The qualification process will follow the procedures outlined in Sections 230.01.01 to 230.01.05, except the representative performing the inspection will be HQ Central Laboratory personnel and the qualification will be Form ITD-926 HQ Issued Laboratory Qualification.

SECTION 230.00 LABORATORY QUALIFICATION PROCESS

230.01 Inspection and Qualification Requirements for Quality Control Laboratories and ITD Field Laboratories.

230.01.01 Annual Laboratory Inspection.

Unless otherwise noted, the laboratory qualification will be valid for one year from the date on the qualification certificate.

At the request of the laboratory manager, the ITD District Materials Engineer or representative will inspect the laboratory for qualification. The laboratory manager is responsible for requesting inspection at least 60 calendar days in advance of the date the qualification is needed to allow the ITD District personnel to conduct the inspection and issue the qualification prior to testing materials for ITD construction projects. The laboratory manager is required to coordinate with the ITD District Materials Engineer in the inspection and qualification process. The laboratory manager will use Table A-1 of Appendix A to provide the list of test methods the laboratory is requesting for inspection and qualification.

The ITD representative will thoroughly inspect and assess the laboratory as detailed in the On-Site Inspection Report of Appendix A. In addition, the ITD representative will perform spot reviews of equipment calibrations, standardizations, and checks during the inspection in accordance with Section 260.00. The ITD representative that inspects the laboratory must also verify individual testers who perform sampling and testing for non-WAQTC methods as described in Section 250.00 are qualified.

230.01.02 Preliminary Report.

The ITD representative will prepare a Preliminary On-site Inspection Report (Appendix A, ITD-921) following the inspection. The test methods for which the laboratory is requesting qualification will be listed on the report. The report will list any deficiencies identified during the inspection and the associated test method(s). The ITD representative will discuss each deficiency noted in the preliminary report with the laboratory manager in sufficient detail so the laboratory manager understands the scope of the deficiency and what corrective action is required. Both parties will sign the preliminary report. These signatures indicate both parties have read and understand the report. The original Preliminary On-Site Inspection Report is retained by the laboratory owner or manager and a copy is retained for the District file.

ITD does not issue partial, provisional, or stipulated laboratory qualifications. All requirements must be met for all test methods the laboratory intends to perform prior to qualification.

230.01.03 Final Report.

If there are no deficiencies identified during the inspection, the ITD District representative will prepare a Final On-site Inspection Report (Appendix A; ITD-921) and submit it to the District Materials Engineer for review.

When deficiencies are identified in the preliminary report, the ITD representative will, upon request of the laboratory manager, perform a re-inspection to confirm that all deficiencies were corrected. The Final On-site Inspection Report will list all deficiencies as shown on the preliminary report and the corrective action taken by the laboratory to correct each deficiency. The Final On-Site Inspection Report will be reviewed and signed by the District Materials Engineer.

230.01.04 Certificate of Laboratory Qualification.

The District Materials Engineer will review the Final On-site Inspection Report to ensure all conditions for qualification have been satisfied and deficiencies have been corrected and will then prepare and issue the Certificate of Annual Laboratory Qualification (Appendix A, ITD-922).

The laboratory will be assigned a permanent ITD Laboratory Qualification Number that will be written on the Certificate of Annual Laboratory Qualification. The permanent ITD Laboratory Qualification Number will be a four-digit number beginning with the number of the district that qualifies the laboratory, ie, District 1 will use 1000 series, District 2 will use 2000 series, District 3 will use 3000 series, etc.

ITD will affix a number plate to the qualified laboratory. When the laboratory is moved to a different district the original ITD Laboratory Qualification Number will be retained and the number plate will remain affixed to the laboratory. The number plate will remain affixed if the laboratory is sold. The only situation for removal of the number plate is when the laboratory is retired or disposed of. The number plate remains the property of ITD and must be returned to ITD when removed. The ITD Laboratory Qualification Number will be used in a central database to list qualified laboratories.

The Certificate will include the laboratory name and the test methods the laboratory has been qualified to perform, and will be signed by the ITD representative and the District Materials Engineer. The Certificate of Annual Laboratory Qualification is proof of a laboratory's ITD qualification for the listed test methods. The qualification will be valid for one year.

The Final On-site Inspection Report and the Certificate of Annual Laboratory Qualification will be sent to the laboratory within 21 calendar days following the final inspection.

Copies of the Final On-site Inspection Report and the Certificate of Annual Laboratory Qualification will be distributed to Headquarters Central Laboratory and to the District Materials file. Distribution to the District Regional/Resident Engineer is recommended when the laboratory is scheduled to be used for testing on an identified project.

230.01.05 Follow Up On-Site Inspections.

Headquarters or district personnel at ITD may perform an on-site inspection of a qualified laboratory at any time. Scheduled Independent Assurance evaluations are considered on-site inspections on testing equipment and testing personnel. Deficiencies identified will be handled as described in Section 270.00, Laboratory Disqualification.

230.02 ITD District Laboratories and Local Highway District Laboratories.

The HQ Central Laboratory is responsible for annual inspection and qualification of ITD District Laboratories and Local Highway District Laboratories. Qualification is required for those test methods used in the acceptance decision for materials used for ITD construction projects.

230.02.01 Inspection and Qualification Requirements for ITD District Laboratories and Local Highway District Laboratories.

HQ Central Laboratory personnel will perform the following functions annually for each laboratory:

- Inspect the laboratory for the requirements of Appendix A including conformation that equipment calibrations, standardizations, or checks have been performed and documented as outlined in the program for all tests the laboratory performs.
- Spot evaluate equipment calibrations, standardizations, and checks in accordance with Section 260.00.
- Qualify the laboratory personnel performing test methods not covered by a recognized testing technician qualification program (WAQTC, ACI, etc.) as shown in Section 250.00. Observe other test methods not shown in Section 250.00 to ensure proper procedures.
- Observe the laboratory personnel performing selected WAQTC or other test methods as identified (OPTIONAL)
- For ITD District Laboratories, review AMRL Proficiency Sample files for conformance with program requirements.

Following laboratory inspection, a detailed inspection report including noted deficiencies will be forwarded to the District Engineer and the District Materials Engineer (or laboratory manager for Local Highway District Laboratories).

The laboratory will have 45 days after the date of the report to notify the HQ Central Laboratory of the resolution of the deficiencies. When deficiencies are not corrected or the requirements of the program are not met they will be handled as described in Section 270.00, Laboratory Disqualification. A notice of disqualification will be sent to the District Engineer and the District Materials Engineer (or Laboratory Manager for Local Highway District Laboratories)

Once all deficiencies are adequately addressed, the Quality Assurance Engineer will issue the Certificate of HQ Issued Laboratory Qualification (Appendix A, ITD-926). The certificate will show broad categories of qualification rather than list every test method; however, the inspection report must document each test method qualified. An intranet site listing the test methods the districts are qualified to perform will be maintained by Central Laboratory. Laboratory Qualification for ITD District and Local Highway District Laboratories are valid for one year.

230.02.02 ITD District Laboratory Operations.

The District Materials Engineer is responsible for ensuring the requirements of the program are met for laboratory qualification, including ensuring equipment calibrations, standardizations, or checks are completed and documented at the frequencies required in this program.

The HQ Central Laboratory will coordinate annual statewide calibration/standardization contracts for ITD District scales, balances, ignition ovens, calipers, micrometers, and force/compression equipment.

The District Materials Engineer must ensure laboratory testing technicians are qualified per Section 250.00. The District Materials Engineer should periodically evaluate the laboratory testing technician's performance. Testing technician qualification and evaluations must be documented.

ITD District laboratories are required to participate in the AASHTO Materials Reference Laboratory (AMRL) proficiency sample program based on the testing performed by the individual District Laboratory.

Participation in the AMRL Proficiency Sample program is required for ITD District Laboratory Qualification. The District Materials Engineer will monitor the proficiency sample reports to ensure reliability of laboratory testing. The District Materials Engineer will maintain a file of all AMRL sample test reports submitted to AMRL and the preliminary and final AMRL Reports. Any result that is beyond two standard deviations from the average is deemed poor. (On a scale from 0-5, scores of 0, 1 and 2 require a written response to the file.) When poor results are reported the District Materials Engineer will within 60 days of the date of the final report 1) investigate to determine the reason(s) for the poor results, (2) document the results of the investigation and any corrective actions taken, (3) maintain records of the investigation and corrective action(s) taken, and (4) provide copies of investigation and corrective action records to the Quality Assurance Engineer.

230.02.03 Local Highway District Laboratory Operations.

The Local Highway District Laboratory manager is responsible for ensuring the requirements of the program are met for laboratory qualification, including ensuring that equipment calibrations, standardizations, and checks are completed and documented at the frequencies required in this program.

The Local Highway District Laboratory manager must ensure laboratory testing technicians are qualified per Section 250.00. The Local Highway District Laboratory manager should periodically evaluate the laboratory testing technician's performance. Testing technician qualification and evaluations must be documented.

230.03 HQ Central Laboratory.

The HQ Central Laboratory is AASHTO accredited and participates in the AMRL and CCRL proficiency sample programs. The specifics of the HQ Central Laboratory accreditation are contained in the Laboratory Quality Control Binder at HQ Central Laboratory. AASHTO accreditation is in accordance with the AASHTO Accreditation Program Procedures Manual and AASHTO R18 "Recommended Practices for Establishing and Implementing a Quality System for Construction materials Testing-Laboratories". The Quality Assurance Engineer must ensure laboratory testing technicians are qualified per Section 250.00.

SECTION 240.00 CONFLICT OF INTEREST

In order to avoid an appearance of a conflict of interest, any non-ITD laboratory is allowed to perform only one of the following types of testing on the same project:

- Verification testing
- Quality control testing
- IA testing
- Dispute resolution testing

All levels of testing by the contractor or his designated laboratories to control the quality of a product are considered quality control testing. When properly verified by Quality Assurance testing, quality control test results may be used for acceptance of material when specified in the contract.

The laboratory performing quality control testing is allowed to prepare mix designs for the same project as long as they meet the requirements of section 225.00.

The laboratory performing verification testing is allowed to prepare mix designs for the same project as long as they do not perform quality control testing, IA testing or dispute resolution testing and meet the requirements of section 225.00.

The Federal law specifies no laboratory may perform both Quality Control and Quality Assurance testing for the same construction project.

SECTION 250.00 Qualification Requirements for Personnel Who Perform Sampling and Testing

Information found in this section can also be found in the Quality Assurance Manual, Section 590.

Qualifications are granted by ITD through the STQP. The purpose of the ITD STQP is for conformance to State and Federal requirements. All individuals shall be qualified who sample or test on ITD projects. Valid sampler / tester qualification for ITD projects is only available through this program.

The ITD STQP includes Six (6) Western Alliance for Quality Transportation Construction (WAQTC) modules, two (2) ITD STQP modules, and eighteen (18) individual test method qualifications.

Details on the five WAQTC and three ITD STQP modules are located in the Registration Policies and Information Hand book (RP &IH) which can be downloaded from the Sampler Tester qualification web page. http://itd.idaho.gov/highways/ops/materials/techqual/techqual.asp Details on individual test method qualifications are found in section 250.10.

Qualification (s) are valid when posted on the ITD's web page under "Inspector and Sampler / Tester Qualification (WAQTC).

250.10 Individual Test Method Qualifications.

Table 1 below lists the individual test methods that require qualification. Prerequisite Sampler / Tester (WAQTC) qualifications are required before any performance examination can occur. Performance exam documentation (Registration Form, Rights and Responsibilities form, and Performance Exam Checklist) shall be submitted to the Quality Assurance Engineer at HQ Central Laboratory. The Individual Qualification certificate is form ITD-949 for all test methods.

Qualification(s) are valid when posted on ITD web page under "Idaho Individual Qualifications."

The individual qualification is valid for five (5) years.

The District Independent Assurance Inspector (I.A.I.) or an I.A.I. assigned ITD qualified person with 5 years experience will provide individual qualifications unless otherwise specified. ITD's performance exam checklist must be used.

250.10.1 Non-ITD Personnel.

The Laboratory Manager will notify the ITD representative who qualifies the laboratory or the District I.A.I. which testing personnel will require individual qualification. Notification shall be made a minimum of 14 calendar days in advance.

Table 1 Individual Test Methods

Test Method	Test Reference	Notes For Pre-Qualification
Aggregates		
Cleanness Value	Idaho IT 72	AgTT Qualification is required.
Specific Gravity and Absorption of Fine Aggregate	Idaho IT 144	AgTT Qualification is required. Performance exam administered by HQ Central Laboratory
Bulk Density ("Unit Weight") and Voids in Aggregate	AASHTO T19	AgTT Qualification is required.
Specific Gravity and Absorption of Fine Aggregate	AASHTO T 84	AgTT Qualification is required.
Uncompacted Void Content Of Fine Aggregate	AASHTO T 304	AgTT Qualification is required.
Flat and Elongated Particles in Coarse Aggregate	ASTM D4791	AgTT Qualification is required.
Bituminous Materials		
Saybolt Viscosity	Idaho IT 61	AsTT Qualification is required.
Bituminous Coating	Idaho IT 96	AsTT Qualification is required.
Anti-strip Detection	Idaho IT 99	
Hveem Stability	AASHTO T 246	AsTT Qualification is required. Performance exam administered by HQ Central Laboratory
Effect of Water on Compressive Strength of Compacted Bituminous Mixtures	AASHTO T 165	AsTT Qualification is required. Performance exam administered by HQ Central Laboratory
Preparation of Test Specimens for Cal. Kneading Compactor	AASHTO T 247	AsTT Qualification is required. Performance exam administered by HQ Central Laboratory
Density of In-place HMA Pavement by Electronic Surface Contact Device	AASHTO T 343	DTT Qualification is required.
Bulk Specific Gravity and Density of Compacted Hot Mix Asphalt (HMA) using Automatic Vacuum Sealing Method (CoreLok)	AASHTO T 331	AsTT Qualification is required.
Field Sampling Bituminous Material after Compaction (Obtaining Cores)	WAQTC TM 11	AsTT Qualification is required.
Soils		
Determining the Plastic Limit and Plasticity Index of Soils	AASHTO T 90	EbTT Qualification is required.
Determining the Liquid Limit of Soils	AASHTO T 89	EbTT Qualification is required.
Specific Gravity of Soils	AASHTO T 100	EbTT Qualification is required.
Concrete		
Sampling & Fabrication of 2" Cube Specimens using Grout or Mortar	AASHTO TP 83	CTT Qualification is required.
Compressive Strength of 2" Cube Specimens using Hydraulic Cement Mortar	AASHTO T-106	CTT Qualification is required

SECTION 260.00 CALIBRATION, STANDARDIZATION AND CHECK REQUIREMENTS FOR TESTING EQUIPMENT

Equipment used to test materials for ITD construction projects must be calibrated, standardized, and checked at the frequencies required in Table A-2 of Appendix A. Table A-1 of Appendix A lists each test method and the equipment associated with performing the test method. The equipment shown in bold on Table A-1 requires calibration, standardization, or check under this program. Appendix B provides the required procedures and sample worksheets for documenting this process.

Calibration: A set of operations that establish, under specified conditions, the relationshipbetween values of quantities indicated by a measuring instrument or measuring system, orbetween values represented by a material measure or a reference material, and the correspondingvalues realized by standards. Calibration allows equipment adjustment to an exact standard such as scales and balances.

Standardization: A process that determines (1) the correction or correction factor to be appliedto the result of a measuring instrument, measuring system, material measure, or reference materialwhen its values are compared to the values realized by standards, (2) the adjustment to be appliedto a piece of equipment when its performance is compared with that of an accepted standard orprocess. Standardization creates a correction for equipment to a known standard such as thermometers, unit weight buckets, ovens.

Check: A specific type of inspection and/or measurement performed on the physical propertiesof equipment and materials to determine compliance or otherwise with stated criteria. Checks are performed on equipment that cannot be adjusted, altered, modified, to meet a standard such as, sieves, slump cones, sand equivalent shaker

Equipment for which there is not an established procedure or frequency for calibration, standardization, but that requires a certain precision, such as a graduated cylinder or strike off plate, must be evaluated (checked) for meeting the precision requirements upon placing the equipment in to service and routinely thereafter, but does not require documentation. Newly purchased equipment or equipment acquired from other sources without existing records must be calibrated, standardized or checked before being placed in service per the requirements of Table A-2.

In some cases equipment calibration or standardization by a commercial calibration service is required. This means the calibration or standardization is performed by hiring a company that has certified standard measuring devices and has qualification from a recognized laboratory accreditation program, such as ISO, ANSI, NIST, to perform this process. Measuring equipment used in equipment standardization and calibration must be checked annually using NIST-traceable standards.

Equipment calibration, standardization, and checks must be performed by properly qualified personnel or by a commercial calibration service.

Each piece of laboratory test equipment must be permanently marked or labeled to clearly identify the piece of equipment for the laboratory's inventory record.

If laboratory test equipment is overloaded, mishandled, giving results that are suspect, or is not meeting specification tolerances, the lab supervisor will remove it from service and mark it by attaching a clearly visible tag or ribbon. The equipment will be returned to service only after appropriate repairs are made and calibration, standardization, or check shows the equipment to function satisfactorily or to meet specification tolerances.

As a requirement for Laboratory Qualification under this program, every testing laboratory must:

- Maintain an equipment inventory (ITD-920) of all the equipment, including the date when the calibration, standardization, or check was performed, and the date the equipment was placed and removed from service.
- Document on calibration, standardization, or check worksheets each step of the associated procedure and record any associated measurement and/or calculations. See Appendix B for procedures and worksheets.
- Have the documented record from the commercial calibration service of any equipment they calibrated, standardized, or checked. Documentation includes the name and date of the person who performed the procedure as well as the name of the accredited organization where the person received their qualification to perform calibrations, standardizations, and checks.
- Have available up-to date equipment inventory (ITD-920) and calibration, standardization, and check worksheets on the premises of the laboratory at all times for inspection.
- Include Independent Assurance test reports (copy of ITD-857) in the laboratory records.

260.01 Laboratory Equipment Documentation.

Every testing laboratory must have complete documentation as outlined above available on the premises of the laboratory at all times. Usually this consists of a binder containing all the required documents organized as indicated above, namely, equipment inventory, calibration, standardization, and check worksheets and Independent Assurance evaluations. The current ITD issued laboratory qualification certificate and final inspection report must also be included.

SECTION 270.00 Laboratory Disqualification

270.01 Disqualification

Disqualification can occur when any or all of the following deficiencies are found; lack of compliance with the laboratories Quality Management System, use of non-qualified Sampler / Testers; use of non-calibrated, non-standardized, non-checked or tagged equipment; fraud, and / or misconduct.

270.02 Disqualification Process

The Idaho Sampler/Tester Qualification Committee (STQC) may disqualify a laboratory at any time. All actions taken by the STQC may be applied to an individual laboratory or all laboratories operated under the same Quality Management System (QMS).

The process for disqualification will start with a written submittal to the STQC chairman. Such a request should contain information regarding who was involved, when the incident happened (date), what was observed, and the name, address and telephone number of the person making the report.

Within 100 days of receipt of the request, the STQC will review for merit. If the information has merit, the STQC will perform an investigation. A letter detailing the incident will be sent to the laboratory in question. The laboratory will be given an opportunity to respond in writing within 15 working days. The STQC will review the laboratory's response and may conduct additional interviews. At any point in the process if the STQC determines that insufficient evidence exists to continue the investigation, the matter will be dismissed.

Upon receipt of all information and responses as outlined above, the STQC will make a determination as to whether the violation falls under the definition of either Negligence or Abuse.

Negligence is defined as unintentional deviations from approved procedures or the unintentional failure to follow the requirements of the ITD Laboratory Qualification Program. This includes but not limited to deficiencies such as, unintentional use of damaged or non-calibrated, non-standardized, non-checked equipment, unintentional expiration of annual qualification, or untidy laboratories.

Abuse is defined as intentional deviations from approved procedures or the intentional failure to follow the requirements of the ITD Laboratory Qualification Program. This would include habitual negligence, and not correcting deficiencies as outlined in Section 270.01.

Once a determination has been reached on the category of the violation the appropriate process outlined below will be followed.

270.02.01 General Procedures Applicable to Both Categories of Violations.

A letter of determination will be mailed to the laboratory in question. The notice will also contain an explanation of the laboratory's right to appeal the decision, the procedure for an appeal, and the time frames within which the appeal must be filed.

A disqualification is effective upon mailing of the notice to the laboratory and is effective unless modified, or vacated following an appeal.

270.02.01.01 Process for Neglect.

Neglect is less severe than abuse and should be resolved in a positive fashion so that learning and increased knowledge can happen. The complaint process for neglect is intended primarily to allow a means of tracking the types of problems & issues being encountered.

A single incident of neglect may be resolved through intervention by the District Independent Assurance Inspector (IAI). The IAI will supply clarification to the laboratory on proper testing and equipment calibration, standardization and check techniques per the Quality Assurance Manual. A copy of the "District Independent Assurance Inspectors Report Field Evaluation" (ITD 857) will be sent to the STQC. The STQC will maintain a file containing those incidents.

If an incident of neglect is found to be "significant" in nature the STQC will issue a letter requiring a corrective action plan be developed by the laboratory to help avoid further incidents. The STQC will send out a notice to all the District IAI's of the issue. This notification is intended to help make the IAI's aware of particular problems being encountered.

Cases of repeated incidents of neglect or multiple incidences of the same type of neglect may be determined as habitual in nature, raising the current incident to the "abuse" category.

270.02.01.02 Process for Abuse.

The STQC will determine the merits of the complaint and also the severity level of the abuse. Abuse will be identified as one of two different levels of severity.

The first level of abuse is identified as the least severe. This level would typically be identified as intentional deviations from approved procedures with no evidence of intent to misrepresent the quality of material being incorporated in the project. This level of abuse could result in up to a 180 day disqualification. The exact duration of the disqualification will be set by the STQC depending on the circumstances encountered. A second incident of this level of abuse within a three (3) year period would result in a minimum one (1) year disqualification.

The second level of abuse is much more severe and is identified by intentional deviations from approved procedures with the intent to misrepresent the quality of material being tested. This level of abuse will be dealt with by a minimum of one (1) year disqualification and up to permanent disqualification. A second instance of this level of abuse will result in permanent disqualification of the laboratory.

270.02.01.03 Process of Appeal.

After receiving notification of disqualification, the laboratory will be given an opportunity to appeal in writing within 15 working days of the date of the decision letter. Such an appeal must state the factual basis for the appeal and the reasons the appellant believes the decision was in error. Written appeals shall be directed to the Idaho Transportation Department, Division of Highways, and Highways Program Oversight Engineer.

A copy of the notice of appeal will be delivered to the STQC Chairman upon receipt. Within 15 days of the receipt of the notice of appeal, the STQC Chairman or his designee will file a reply to the appeal to the Highways Program Oversight Engineer.

A decision will be sent within 45 days of the receipt of the notice of appeal. The decision of the Highways Program Oversight Engineer will be final.

SECTION 280.00 ACCESS

Laboratory facilities, equipment calibration, standardization, and check records, test data applicable to ITD projects, and the laboratory Quality Management System documents will be accessible to ITD personnel at all times. Failure to produce records may constitute disqualification.

SECTION 290.00 – Appendix Content

The forms and references found in Appendix A are as follows:

Table A-1***:*** Test Methods & Equipment***.***

This table lists test methods covered under the program and lists the equipment associated with each test method. Equipment that requires calibration, standardization, or check under this program is shown in bold.

The table has a column to indicate the required qualification for Sampler and Tester personnel.

Table A-1

√	*Test Methods*	Sampler / Tester qual	Equipment Used – Calibration, Standardization, or Check Required Bold
	Aggregates		
	AASHTO T-11 Wash fines	AgTT	**Balance** / **Sieves** / Container / **Oven** / Wetting Agent
	AASHTO T-19 Bulk Density ("Unit Weight") and Voids in Aggregate	Individual	**Balance** / Tamping Rod / Measure, Shovel Or Scoop / Standardization Equipment (Plate Glass) / **Unit Weight Bucket**
	AASHTO T-27 Gradation	AgTT	**Balance** / **Sieves** / **Mechanical Shaker** / **Oven**
	AASHTO T-84 Specific Gravity and Absorption of Fine Aggregate	Individual	**Balance** / **Pycnometer** / **Specific Gravity Mold and Tamper**
	AASHTO T-85 Specific Gravity and Absorption of Coarse Aggregate	EbTT	**Balance Or Scale** / **Sieves**
	IT-144 Specific Gravity and Absorption of Fine Aggregate Using Automatic Vacuum Sealing (CoreLok) Method	Individual	**Balance** / **Oven** / **Pycnometer** / **CoreLok**
	AASHTO T-96 L. A. Wear	N/A	**L.A Abrasion Machine** / **Steel Spheres** / **Sieves** / **Oven** / **Balance**
	AASHTO T-176 Sand Equivalent	AgTT	**Sand Equivalent Apparatus**
	AASHTO T-248 Splitting	AgTT	**Mechanical Splitter** / **Straightedge** / Scoop / Shovel / Broom / Canvas Blanket
	AASHTO T-255 Moisture	AgTT	**Balance** / **Oven** / Sample Container / Stirrer
	AASHTO T-265 Moisture	EbTT	**Balance** / **Oven** / Containers
	AASHTO T-304 Uncompacted Void Content – Fine Aggregate Angularity	Individual	**Cylindrical Measure** / Funnel And Stand / Glass Plate / **Balance** / Pan, Metal Spatula
	AASHTO T-335 Fracture	AgTT	**Balance** / **Sieves** / **Splitter**
	IT-72 Cleanness Value	Individual	**Balance** / **Sieves** / **Splitter** / Graduated Plastic Cylinder / SE Stock Solution / Washing Vessel
	ASTM D4791 Flat or Elongated Particles in Coarse Aggregate	Individual	Proportional Caliper Device / **Balance**
	IT- 74 Vibratory Spring-Load Compaction for Coarse Granular Material	N/A	Vibratory spring loaded Compactor / Mold Piston, **Molds**, Tamping rod, **Balance** / **Scale**, **Oven**, **Sieve**
	Bituminous Materials		
	AASHTO T-30 Mechanical Analysis of Extracted Aggregate	AsTT or ASTT II	**Balance Or Scale** / **Sieves** / **Mechanical Shaker** / **Oven** / Containers And Utensils / Wetting Agent
	AASHTO T-59 Saybolt Visc.or IDAHO T-61	Individual	**Viscometer** / **Sieve** / **Thermometer** / **Constant Temperature Bath**
	AASHTO T-165 Immersion-Compression	Individual	**Constant Temperature Bath** / **Balance** / Glass plate / **Immersion – Compression Mold**
	AASHTO T-166, Method A or Method C,	AsTT or ASTT II	**Scale** / **Oven** / **Constant Temperature Bath**
	AASHTO T-275 Bulk Specific Gravity of Compacted Bituminous Mixtures using Paraffin coated Specimens	AsTT or ASTT II	**Paraffin** / **parafilm**, **Scale** / **Oven** / **Constant Temperature Bath**
	AASHTO T-209 Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures	AsTT or ASTT II	**Balance Or Scale** / **Constant Temperature Bath** / **Thermometer** / **Timer** / Containers, Utensils / **Vacuum Pump & Gauge**, **Lid (Vacuum System)** / **Gravity Bowl**
	AASHTO T-246 Stability (Hveem)	Individual	**Stabilometer** / **Test Machine** / **Oven** / Calibration Cylinder / **Follower** / Rubber Bulb
	AASHTO T-247 Compaction by Kneading Compactor	Individual	**Kneading Compactor** / Compactor Foot / Mold Holder / **Molds** / **Follower** / **Test Machine** / **Oven** / **Balance** / **Splitter** / Rod / Paper Disks / Shim / Mixing apparatus / trowels / scoops / pans
	AASHTO T-308 Method for Determining the Asphalt Content of Hot Mix Asphalt (HMA) by the Ignition Method	AsTT or ASTT II	**Ignition Oven** / Sample Basket assembly with Catch Pan / **Oven** / **Balance** / Misc. Spatulas, Bowls, Brushes

Table A-1

√	*Test Methods*	Sampler / Tester qual	Equipment Used – Calibration, Standardization, or Check Required Bold
	IT-96 Bituminous Coating	Individual	**Sieves** / Sample Pan / Scoop / Rags / Manila Paper / Brush / Spatula /
	AASHTO T--343 Density of In-Place (HMA) Pavement by Electronic Surface Contact Devices	Individual	**Electronic Density Gauge**
	AASHTO R 47 Reduce HMA	AsTT or ASTT II	Scoop / Non-Stick Mat / Trowels, Etc.
	AASHTO T-312 Gyratory Compactor	ASTT II	**Gyratory Compactor, molds**
	AASHTO T-329 Moisture	AsTT	**Balance / Oven / Thermometer** / Container
	WAQTC TM-8 Density	DTT	**Nuclear Density Gauge**
		Concrete	
	AASHTO T-22 Compressive Strength of Cylindrical Concrete Specimens	CLTT	**Test Machine / Bearing Blocks** / Load Indicator / **Constant Temperature Bath**
	AASHTO T-23 Method of Making and Curing Concrete Test Specimens in the Field	CTT / ACI-CFT	Initial Curing Facility / **Thermometer** / Single Use Mold
	AASHTO T-119 Slump	CTT / ACI-CFT	**Slump Cone** / Tamping Rod
	AASHTO T-121 Unit Wt., etc.	CTT / ACI-CFT	**Balance** / Tamping Rod / **Measure**
	AASHTO T-152 Air content	CTT / ACI-CFT	**Air Meters** / Measuring Bowl / Cover Assembly / Calibration Vessel / Spray Tube / Trowel / Tamping Rod / Mallet / Strike-Off Bar / Strike-Off Plate / Funnel / Measure For Water / **Sieves**
	AASHTO T-231 Capping Cylindrical Concrete Specimens	CLTT	**Capping Plates** / Alignment Devices / **Capping Compound / Cylinder Capping Mold**
	ASTM 1231 Use of Unbonded Caps in Determination of Compressive Strength of Concrete Cylinders.	CLTT	Unbonded caps / Retaining Ring
	AASHTO T-309 Temperature of Freshly Mixed Concrete	CTT / ACI-CFT	**Thermometer**
	AASHTO TP 83 Sampling & Fabrication of 2" Cube Specimens using Grout or Mortar	Individual	**Cube Molds** / Tamper / Trowel / Clamps
		Soils	
	AASHTO T-89 Determining the Liquid Limit of Soils	Individual	**Balance / Oven / Liquid Limit Device / Grooving Tool**
	AASHTO T-90 Determining the Plastic Limit and Plasticity Index of Soils	Individual	**Balance / Oven**
	AASHTO T-99 Moisture Density Curve	EbTT	**Molds / Rammer** / Sample Extruder / **Balance & Scale / Oven / Straightedge** / Mixing Tools / Containers
	AASHTO T-100 Specific Gravity of Soils	Individual	**Pycnometer / Balance / Oven / Thermometer**
	AASHTO T-180 Moisture Density curve	EbTT	**Molds / Rammer** / Sample Extruder / **Balance & Scale / Oven / Straightedge** / Mixing Tools / Containers
	AASHTO T-288 Determining Minimum Laboratory Soil Resistivity	N/A	**Balance / Oven / Sieves** / Pulverizing Apparatus / **Splitter**
	AASHTO T-289 Determining pH of Soil for Use in Corrosion Testing	N/A	**Sieves / Balance / Oven** / Pulverizing Apparatus / **Splitter**
	AASHTO T-310 Density	DTT	**Nuclear Density Gauge**
	IT-8 Compaction of Soils and Soil Mixtures for the Expansion Pressure and Hveem Stabilometer Tests	N/A	**Mechanical Kneading Compactor / Proctor Molds / Soil (R-Value) Molds**

Table A-2***: Equipment, Calibration, Standardization, or Check Procedures & Frequency.***

This table lists the equipment requiring calibration, standardization, or check; the required calibration, standardization, and check procedure, and the required calibration, standardization, and check frequency.

Table A-2

Equipment	Required Procedure & Worksheet Number		Frequency(months)
Air Meter	ITD-S102	27	3
Balance	Commercial	-	12
Balance, Analytical	Commercial	-	12
Balances, Electronic	Commercial	-	12
Bearing Blocks	ITD-S103	30	12
Calipers	Commercial	-	12
Capping Compound	ITD-S014	28	12
Constant Temperature Bath, Water or Oil	ITD-B24	15	12
Const. Temp Bath for Concrete / Cement	ITD-S108	24	6
Concrete Capping Stand	ASTM C617	32	12
Cylinder Capping Molds	ITD-S107	29	12
Followers, Plungers, Shims, Rods	ITD-D20	11	12
Furnace, Ignition	Commercial	-	12
Furnace, Ignition (Balance Verification)	ITD-NCAT1	9	Monthly when in use or when moved
Furnace, Ignition (Air Flow Check)	ITD-NCAT1	9	Weekly when in use
Gravity Bowls	ITD-D21	10	12
Gyratory Compactor	Commercial	-	12
Kneading Compactor	Commercial	-	12
L. A. Wear Machine	ITD-D1	21	24
L. A. Wear Steel Spheres	ITD-D1	21	24
Liquid Limit Device and Grooving Tool	AASHTO T89	19	12
Micrometers	Commercial	-	12
Mold, 2 inch cubes	ASTM C109	31	12
Mold, Gyratory, including Top and Bottom Plate	Commercial	-	12 months or 80 hours use
Mold, Hveem	ITD-D19	13	12 or 80 hours
Mold, Hveem	ITD-D19	13	12
Mold, Immersion / compression	ITD-D19	13	12
Mold, Moisture Density (Proctor)	ITD-D42	16	12
Mold, Soils (R-value)	ITD-D42	13	12
Unbonded Caps	ASTM C-1231	34	12
Nuclear Gauges	Commercial	-	24
Oven, Drying	ITD-2	1	12
Pycnometer	ITD-D37	20	12
Rammer, Manual Moisture Density	ITD-D40	17	12
Rammer, Mechanical	ITD-D41	17	12
Sand Equivalent Apparatus	ITD-D3	3	12

Scale	Commercial	-	12
Shaker, Mechanical Coarse & Fine	ITD-D5	2	12
Sieves	ITD-D11	5	12
Slump Cone	ITD-S105	23	12
Specific Gravity Mold & Tamper	ITD-D6	18	12
Splitter (Riffle)	ITD-D7	6	12
Stabilometer	Commercial	-	12
Straight Edge	ITD-D43	8	12
Test Machine	Commercial	-	12
Thermometer	ASTM E77	26	12
Temperature Recorder	ITD-B-22	26	6
Timer	ITD-D9	7	12
Unit Weight Bucket	ITD-D10	25	12
Unbonded Cap Retaining Ring	ASTM C-1231	33	12
Vacuum System	ITD-D18	12	12
Viscometer, Saybolt	ITD-B26	14	36
Core Lok	ASTM D 6752		3

ITD-921: On-site Inspection Report

This form is used by the ITD representative to evaluate laboratories for qualification.

ITD-920: Laboratory Testing Equipment Inventory

This form is used to record the laboratory inventory of testing equipment and date of calibration.

ITD-922: Annual Laboratory Qualification Certificate

This form is used by ITD District Materials to qualify laboratories.

ITD-926: HQ Issued Laboratory Qualification Certificate

This form is used by ITD HQ Central Laboratory to qualify laboratories.

ITD-949: Individual Technician Qualification

This form is used by both ITD HQ Central Laboratory and ITD District Materials to qualify sampler / tester personnel for non-WAQTC test methods.

Table A-3*: Procedure Checklist AASHTO R-18 Quality Systems Manual*

This table lists the requirements outlined in AASHTO R-18 for the Quality Systems Manual.

Table A-3				
Quality Management System		P	F	N/A
1.	QMS available for use and understood by staff			
2.	Organization and Organizational Policies available			
3.	QM contains the legal name and address of the CML			
4.	Quality system policy statement and objectives – set by management			
5.	Brief biographical sketch available			
Document Control				
6.	Preparation – revision date indicated			
7.	Test Methods and Procedures are the most current and are readily accessible employees performing the work			
Organization				
8.	Technical manager named that has overall responsibility for the technical operations of the laboratory – backup named in case of managers absence			
9.	Person listed having responsibility for determining if quality system implementation activities are being conducted – has direct access to top management. Management reviews the quality system annually, and whenever a technical complaint casts doubt			
Technician Training				
10.	Procedure to describe method used to ensure personnel are trained to perform test			
11.	Document shall indicate position responsible for training and maintenance of records			
Internal Audit				
12.	Document describing scope of Internal Audit			
13.	Verify lab's operation comply with its policy and procedures and standards			
14.	Frequency of review and identification of responsible person for review			
15.	Conducted at least every 12 months by personnel independent of activity being audited			
16.	Findings documented			
Corrective Action				
17.	Procedure for corrective action for nonconforming work			
18.	Equipment Calibration and Checks Available			
Record Retention				
19.	External assessments, internal audits, proficiency sample testing, technician training and evaluation records available minimum of 5 years			
20.	QMS Records Retention shall be retained for a minimum of 5 years			

21.	Test records maintained includes, calculations, derived data and identification of technician retained for a minimum of 5 years			
Equipment				
22.	Inventory of equipment, name, date placed in service, manufacturer, model and serial number			
23.	Equipment calibration and check records maintained, details of work performed, date performed, previous and next due date, calibration procedure used and check equipment			
24.	Methods for ensuring that the calibration and check procedures are performed with individual responsible			
25.	In house equipment calibration and check procedures, when they cannot be referenced inapplicable standards			
26.	Certificates or other documents that establish the traceability of in house equipment or reference standards used in calibration			
Sample Management				
27.	Typical test report forms which illustrate the manner in which tests results and supporting information available			
28.	Document describing procedures for sample identification, storage			
Test Records				
28.	Methods used to produce test records and to prepare, check and amend test reports			
30.	Records contain sufficient info to permit verification of data			
31.	Document describing the policies which the lab follows relative to subcontracting			
Assuring Quality of Results				
32.	Documents describing participation in proficiency sample and on site assessment programs, methods used to identify poor results and procedures available			
33.	Root cause analysis for non-conformities and corrective action taken			

Appendix B

Appendix B contains the calibration, standardization, and check procedures listed in Table A-2 and the associated sample worksheets.

The laboratory is required to use the calibration, standardization, and check procedures shown for the equipment but the actual worksheet is optional as long as the same information is documented when performing the calibration, standardization, and check procedures.

Table B-1 – Calibration, Standardization and Check Procedures & Worksheets

Procedures	Worksheets	Equipment
1	1	Drying Oven Temperature
2	2	Mechanical Sieve Shaker
3	3	Sand Equivalent Apparatus
4	4	Wire cloth sieves
5	5	Sieves
6	6	Splitter (Riffle)
7	7	Timer
8	8	Straight Edge
9	9	Ignition Furnace Equipment
10	10	Maximum Theoretical Specific Gravity Bowl
11	11	Plungers, Followers, Supports, Shims and Rods
12	12	Vacuum System
13	13	Immersion / Compression Molds
13	13	Hveem Molds

Standardization Procedure: ITD-D2

Drying Oven Standardization

Inspection Equipment Required:

1. A standardized thermometer graduated in 1.0 C increments having a range which includes the temperature range to be checked
2. A brass thermometer well to retain heat while the oven door is open. This is essential for a constant temperature reading.
3. A clothes pin to hold the thermometer in such a manner as to enable the operator to read the scale easily from outside of the oven.

Tolerance:

Drying ovens shall be capable of maintaining a constant temperature range listed in the appropriate test methods.

Procedure:

1. Place the thermometer inside the brass well with the clothes pin attached to the thermometer. Position the thermometer on the shelf where the samples are normally dried.
2. Take the first reading at least 1 hour after closing the oven (oven should remain undisturbed).
3. Take as many readings as necessary to determine if the temperature range is within the specified tolerance (Three consecutive readings, taken no less than 1/2 hour apart, within the tolerance allowed are adequate.)
4. Adjust the temperature of the oven if an observed temperature reading is outside the tolerance specified (Allow at least 1/2 hr. for the temperature to stabilize between each adjustment.) Return to step 3.
5. Record the Serial No. of the thermometer being used.

Drying Oven Temperature Standardization Record

Standardization Procedure: ITD-2

Standardization Frequency: 12 months

Identification Number:	Date Standardized:
Manufacturer:	Model No:
Serial No.:	Temperature Working Range:
Standardized Thermometer Number:	Standardization Data: ☐ As Found ☐ As Adjusted

Reading	Time1	Temp1	Time2	Temp2	Time3	Temp3
1						
2						
3						

Oven Temperature Control Setting:	
Accuracy Requirement: +/- 5C, 9F	Within Required Range? ☐ Yes ☐ No
Temperature Range for which oven is qualified:	Disposition of Oven: ☐ Acceptable ☐ Not Acceptable

Remarks:

Standardized by:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE- STANDARDIZATION DUE DATE:**

Check Procedure: ITD-D5

Mechanical Sieve Shaker Check

General Equipment**:**

1. Ensure shaker imparts a vertical, or lateral and vertical motion to the sieve, so as to cause particles to present different orientations to the sieving surface.
2. Lubricate shaker as specified by manufacturer.
3. Evaluate all mechanical and operational moving parts of the shaker for wear and proper operating tolerances specified by manufacturer's maintenance specifications.
4. Record the observation, deficiency and any comments.

Sieve Shaker Check

AASHTO T27, Sections 6.3 & 8.4

Apparatus:

1. Typical sieve or screen stack used in the shaker
2. Balance readable to 0.1g
3. Timer

Sample Size

A dry aggregate sample with coarse and fine material will be used as follows:

1. For 12" round sieve shaker – use minimum of 2000 grams (+50 grams) with the maximum sieve size the 3/8" sieve.
2. For 8" round sieve shaker – use minimum of 1000 grams (+50 grams) with the maximum sieve size the ½" sieve.
3. For 14" or 16" coarse screen shaker – use minimum of 4000 grams (=50 grams) with the maximum screen size the 1" screen

Procedure:

1. Determine total sample mass and record
2. Place sample in top of sieve stack and begin shaker.
3. Shake sieve stack for a set amount of time between 5 and 10 minutes.
4. Hand-sieve each individual sieve, that has been snugly fit with a pan and cover, by holding the sieve in a slightly inclined position in one hand. Strike the side of the sieve sharply and with an upward motion against the heel of the other hand at the rate of about 150 times per minute, turn the sieve about one-sixth of a revolution at intervals of about 25 strokes.
5. Determine the mass of the material in the pan after hand-sieving for 1.0 minute.
6. Divide the mass of the material in the pan (B) by the total sample mass (A).
7. The mass in the pan but be not more than 0.5 percent (0.005) of the total sample mass. If B/A is greater than 0.005 then the time shaken is not sufficient. Restart the procedure with step 3 and shake the sieve stack for 2.0 minutes longer than the previous trail time until the tolerance of 0.005 is obtained after 1.0 minute of hand-sieving. The tolerance must be obtained without the shake time exceeding 15.0 minutes.
8. Continue to hand-sieve, record each individual sieve and calculate whether the percent is within the 0.005 tolerance.
9. Determine and record the required shake time. <u>The required shake time is the minimum amount of time to achieve the 0.005 tolerance.</u>

Mechanical Sieve Shaker Efficiency Check

Check Procedure: ITD-D-5 Check Frequency: 12 months

Date Checked:	Shaker Manufacturer:
Model No. :	Identification No. :
Standard Balance Number:	Mass of Total Sample:

Sieve Size	Sieve Ident. No.	Mass retained by mechanical sieving	Hand Sieving Mass Passing	Hand Sieving % Passing	Acceptable (Y/N)[1]
1”					
3/8”					
No. 8					

Note 1: No more than 0.5%, by mass, of the total sample shall pass any one sieve after one minute of continuous hand sieving.

Minimum mechanical shaking time required _____ minutes	
Shaker was cleaned: ☐	Shaker was lubricated: ☐
Remarks:	

Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE- CHECK DUE DATE:**

.

Check Procedure: ITD-D3

Sand Equivalent Apparatus Check

Inspection Equipment Required:

1. A Timer readable to 1 sec.
2. A Ruler of at least 300 mm in length, reading in mm.
3. A balance capable of reading to 1 g.
4. A number 60 drill bit.
5. A caliper readable to 0.01mm.

Tolerance:

Shaker shall be capable of maintaining constant range listed in the appropriate test methods.

Procedure:

1. Check and record the timer setting at 45 Sec.
2. Measure and record the throw of the shaker arm.
3. Measure and record the number of cycles for 45 seconds.
4. Measure and record the capacity of the tinned box.
5. Verify the wide-mouth funnel to insure it is approximately 100 mm in diameter
6. Weigh and record the weight of the foot.
7. Measure and record the diameter of the foot.
8. Measure and record the height from the top of the working surface to the top of the shelf where solution sits.
9. Measure and record the length, diameter of the irrigator tube.
10. Measure and record that the openings in the end of the irrigator tube are within tolerance.
11. Record Checked By.
12. Record the date of inspection
13. Record any comments

Sand Equivalent Test Apparatus Check Record

Apparatus Requirements: ITD-D3 Check Frequency: 12 months

Identification No.:	Date Checked:
Calibration Balance Number:	

Siphon assembly of proper material and configuration:	☐ Satisfactory ☐ Unsatisfactory
Graduated cylinder:(1.5" dia., 0 to 15" marks +/- 0.3")	☐ Satisfactory ☐ Unsatisfactory
Weighted foot assembly meets proper dimensional requirements: 256.5 mm from bottom of foot to top of ring and 1" (25.4mm) diameter	☐ Satisfactory ☐ Unsatisfactory
Weighted foot assembly: _______________g (ASTM-D2419 range: 995 to 1005g)	☐ Satisfactory ☐ Unsatisfactory
Electronic SE Shaker Ident. No. : _____ Note: If only manual shaking then tester must be qualified.	8 inch stroke ☐ Yes ☐ No 130 to 134 strokes per 45 seconds ☐ Yes ☐ No
Solution Temperature: 72º F +/- 5º	☐ Yes ☐ No
Shelf Height: 36" +/- 1"	☐ Yes ☐ No
Tin: Approx. 2.25" in Diameter and holds 85ml +/- 5 ml	☐ Yes ☐ No
Stainless Steel Irrigation Tube: 510mm long, (1/4") 6.4mm outside diameter	☐ Yes ☐ No
Irrigation Holes: Two #60 drill bit size on each side at end	☐ Yes ☐ No

Disposition of Sand Equivalent Test Apparatus:	☐ Acceptable ☐ Not Acceptable

Remarks:

Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE- CHECK DUE DATE:**

Wire Cloth Sieve Check

AASHTO M92

Procedure: ITD-D11

Procedure for Sieves No. 6 and finer:

1. Record the sieve identification number.
2. Inspect the general condition of the sieve frame as specified in Section 5.0 of AASHTO M92
3. AASHTO M92 ANNEX A1.2, *Test Method One*:
    a. View the sieve cloth against a uniformly illuminated background. If obvious deviations, for example weaving defects, creases, wrinkles foreign matter in the cloth, are found, the wire cloth is unacceptable
4. AASHTO M02 ANNEX, A1.3, *Test Method Two:*
    a. Carefully and methodically examine the appearance of all the openings, in order to detect oversize openings, sequences of large openings and local irregularities. If greater than 10% of the openings are distorted, the wire cloth is unacceptable.
5. Record Checked By.
6. Record Date checked.
7. Record any comments.

Wire Cloth Sieves Check Procedure

Check Procedure: ITD-D-11 Check Frequency: 12 months

Identification No.:	Date:
Manufacturer:	Sieve size:

General condition of sieve frame:	☐ Acceptable ☐ Unacceptable
General condition of sieve cloth, Test #1 Observation of deviations, such as weaving defects, creases, wrinkles	☐ Acceptable ☐ Unacceptable
Sieve opening appearance, Test #2 Observation of oversized openings must be less than 10%	☐ Acceptable ☐ Unacceptable

Remarks:

Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Check Procedure: ITD-D11

Sieve Check

Inspection Equipment Required:

1. A caliper readable to 0.0 I mm (for use with Sieve No. 4 and coarser).

Tolerance:

Sieves shall meet the physical requirements specified in AASHTO M-92 (Annex A1.5 not required)

Procedure for Sieves No. 4 and coarser.

1. Record the sieve identification number
2. Examine the sieve frames in accordance with AASHTO M-92 Section 5.0.
3. Measure the openings in the sieve as per AASHTO M-92 ANNEX A1.4, *Test Method Three* except in A1.4.1 replace the number 30 with the number 10. (measure a maximum of 10 openings, both directions, x & y)
4. Determine and record if the sieve meets the tolerances of AASHTO M-92 Table 1 as shown on the worksheet at a, b and c.
5. Record Checked By.
6. Record Date checked.
7. Record any comments.

Sieve Measurements ITD D11

Identification Number:	Check Date:	Nominal sieve opening, w =#4 (4.75 mm)

Opening #	Opening Size X Vertical	Opening #	Opening Size Y Horizontal
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 5.14 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **c** = 4.60 to 4.90 mm *(table 1, column 4)*	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the openings, **b** = 5.02 mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:

Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b.

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Sieve Measurements ITD D11

Identification Number:	Check Date:	Nominal sieve opening, w = 3/8” (9.5 mm)

Opening #	**Opening Size X Vertical**	**Opening #**	**Opening Size Y Horizontal**
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 10.16 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **c** = 9.20 to 9.80 mm *(table 1, column 4)*	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the opening, **b** = 9.97 mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:

Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b.

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE- CHECK DUE DATE:**

Sieve Measurements ITD D11

Identification Number:	Check Date:	Nominal sieve opening, w = ½” (12.5 mm)

Opening #	Opening Size X Vertical	Opening #	Opening Size Y Horizontal
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 13.31 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **c** = 12.11 to 12.89 mm *(table 1, column 4)*	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the openings, **b** = 13.10 mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:
Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b.

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE- CHECK DUE DATE:**

5

Sieve Measurements ITD D11

Identification Number:	Check Date:	Nominal sieve opening, w = 5/8" (16 mm)

Opening #	Opening Size X Vertical	Opening #	Opening Size Y Horizontal
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 17.0 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **c** = 15.50 to 16.50 mm *(table 1, column 4)*	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the openings, **b** =16.7 mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:
Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b.

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Sieve Measurements ITD D11

Identification Number:	Check Date:	Nominal sieve opening, w = ¾" (19 mm)

Opening #	Opening Size X Vertical	Opening #	Opening Size Y Horizontal
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 20.10 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **b** = 18.40 to 19.60 mm *(table 1, column 4)*	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the openings, **c** = 19.90 mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:

Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b.

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Cheeked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

5

Sieve Measurements ITD D11

Identification Number:	Check Date:	Nominal sieve opening, w = 1” (25 mm)

Opening #	Opening Size X Vertical	Opening #	Opening Size Y Horizontal
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 26.4 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **c** = 24.20 to 25.80 mm *(table 1,* column 4)	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the openings, **b** = 26.1mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:

Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b.

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Sieve Measurements ITDD11

Identification Number:	Check Date:	Nominal sieve opening, w = 1 ½" (37.5 mm)

Opening #	**Opening Size X Vertical**	**Opening #**	**Opening Size Y Horizontal**
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 39.50 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **c** = 36.4 to 38.60 mm *(table 1, column 4)*	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the openings, **b** = 39.10 mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:

Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b.

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Sieve Measurements ITD D11

Identification Number:	Check Date:	Nominal sieve opening, w = 2” (50 mm)

Opening #	Opening Size X Vertical	Opening #	Opening Size Y Horizontal
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 52.6 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **c** = 48.50 to 51.50 mm *(table 1, column 4)*	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the openings, **b** = 52.1 mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:

Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b.

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

5

Sieve Measurements ITD D11

Identification Number:	Check Date:	Nominal sieve opening, w = 3" (75 mm)

Opening #	Opening Size X Vertical	Opening #	Opening Size Y Horizontal
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
Average X		Average Y	

Max. individual sieve opening, **a** = 78.7 mm *(table 1, column 6)*	Met ☐ Not Met ☐
Intermediate tolerance of individual opening, **c** = 72.80 to 77.80 mm *(table 1, column 4)*	Met ☐ Not Met ☐
Sieve opening dimension not exceeded by more than 5% of the openings, **b** = 78.1 mm *(table 1, column 5)*	Met ☐ Not Met ☐

From table of measurements in AASHTO M-92:

Verify individual opening size does not exceed a, and the average of the sieve openings meets the requirements of c and not more than 5% (or 1 maximum) are between a and b

Sieve Disposition:	☐ Acceptable ☐ Unacceptable
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Procedure: ITD-D7

Splitter Check

Inspection Equipment Required:

1. A steel rule readable in mm

Tolerance:

As outlined in AASHTO T-248

Procedure:

1. Select the serial number of the equipment to be checked.
2. Record the number of chutes
3. Measure and record the width of the chutes.
4. Is the dump pan equal to or slightly less than the width of the chutes assembly?
5. Record the date checked.
6. Record checked by.
7. Record any comment

Sample Splitter Check (Riffle)

Check Procedure: ITD-D7 (Ref.: AASHTO T-248) Check Frequency: 12 months

Identification No.:	Calibration Date:
Manufacturer:	Model No.:
Calibration Standard Used:	Ruler Number:

Opening #	**Opening Size**	**Opening #**	**Opening Size**
1		13	
2		14	
3		15	
4		16	
5		17	
6		18	
7		19	
8		20	
9		21	
10		22	
11		23	
12		24	

Is Dump Pan Equal To or Slightly Less Than Width of Chute Assembly?	☐ Yes ☐ No
Splitter Disposition:	☐ Acceptable ☐ Unacceptable

Remarks:

Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE- CHECK DUE DATE:**

Check Procedure: ITD-D9

Timers Check

Inspection Equipment Required:

Timer, readable to 1.0 sec., having a verified accuracy within the tolerance listed in the specified test procedure.

Tolerance:

Timers shall meet the accuracy requirements specified in the applicable test methods.

Procedure:

1. Choose the timer to be checked.
2. Enter the serial number of the timer used to check with.
3. Start both timers simultaneously.
4. Allow both timers to run at least for 15 min. then stop both timers simultaneously.
5. Record the time of the timer to be checked to the nearest 1.0 sec.
6. Record the time of the timer being used for checking the timer to the nearest 1.0 sec,
7. Record the percent of accuracy of the two timers.

%Accuracy= [(A - B) / B] X 100

A = Reading on lab timer (Sec.)

B = Reading on standard timer (Sec.)

Timer Check

Check Procedure: ITD-D9 Check Frequency: 12 months

Identification No.:	Check Date:
Manufacturer:	Model:
Serial No.:	Standardized Standard Timer Identification No:

Start both lab timer and standard timer at the same time, allow to run for at least 15 minutes, then stop both timers simultaneously.

Record time to nearest second on Lab Timer: _____ = A (seconds)
Record time to nearest second on Standard Timer: _____ = B (seconds)
% Accuracy = [(A – B) / B } X 100
% Error = _____

Remarks:

Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE- CHECK DUE DATE:**

Check Procedure: ITD-D43

STRAIGHT EDGE CHECK

AASHTO T-99 2.6

Inspection Equipment Required

1. Tape measure readable to 1\16 "
2. Calipers readable to .0001 "

Tolerance:

The straight edge shall be made of hardened steel at least 250 mm long (10"). It shall have one beveled edge planed to a tolerance of .250 mm per 250 mm (.0 1 " per 1 0''). The straight edge should not flex enough to cause the cutting edge to cut a concave surface on the sample.

Procedure:

1. Measure the straight edge with a tape measure.
2. Measure the beveled edge with calipers, along the entire length of the straight edge.
3. Check the straight edge for flex by placing it on an empty mold and apply pressure in the center of the straight edge.
4. Check planeness of the beveled edge within 0.005” with certified straight-edge.

Straightedge Check Record

Check Procedure: ITD-D-43 Check Frequency: 12 months

Straightedge Identification No.:	Date Checked:
Standard Used: Caliper Number:	

DIMENSIONAL DATA:

Length: ___ Greater than 10”?	☐ Yes	☐ No
Thickness: ___ if greater than 1/8", is scraping edge beveled?	☐ Yes	☐ No
Planeness of edge within 0.005”?	☐ Yes	☐ No
Certified Straightedge used to check planeness	Ident. No.	
Is straight edge non-flexible?	☐ Yes	☐ No

Disposition of Straightedge:	☐ Acceptable	☐ Not Acceptable

Remarks:

Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE- CHECK DUE DATE:**

Ignition Furnace Equipment Standardization Procedure

Standardization Procedure: ITD-NCAT1
Standardization Frequency: Lift Test – weekly when in use Internal Balance – 30 days and following furnace transport

Equipment: Ignition Furnace
** NOTE: These procedures were developed around the Thermolyne (NCAT) ignition furnace. Other manufactures furnaces may be slightly different.

Standard References: AASHTO T-308
Manufacturer's Operation and Maintenance Manual

Purpose:

This method provides instruction on:

- checking the airflow rates through the tester and cleaning the filtration system when needed.
- how to lubricate the blower motor and other routine maintenance and checks.
- transportation in a mobile laboratory.
- field inspection and verification of internal balance verification.

These procedures are in addition to the required annual calibration of the ignition furnaces by a commercial laboratory.

Inspection Equipment Required:

1. Vacuum Cleaner with brush
2. Protective Gloves
3. Synthetic lubricant such as Anderoll 465
4. Screwdriver
5. Calibrated weight set consisting of two 4000 gram N.I.S.T. traceable Class 3 weights. A copy of the N.I.S.T. traceable weight certificates must be retained with the verification weights.

Tolerances:

Lift on the scale should be between –3.5 and -10 grams.
Internal balance verification should be within ±0.05 % of applied weight.

Procedure:

THE FILTRATION SYSTEM MUST BE CLEANED.
BLOWER MOTOR BEARINGS NEED TO BE OILED YEARLY.

(Mixes containing latex, crumb rubber, or polymer modifiers generate more smoke and soot and burning large samples also produce more smoke/soot.)

Checking Airflow Rates:

1. Ignition Furnace must be COLD when checking.
2. Turn the Furnace on using the switch on the control panel.
3. Allow the scale to stabilize (about 20 seconds).
4. Press the START button on the keypad.

5. Watch the scale indicator display once the blower starts. The numbers should be in the range of –3.5 to -10 grams. If the reading is closer to -10, your furnace is getting the correct amount of air. If the reading is at –3.5 grams or lower, the filtration system needs to be cleaned.

Cleaning The Filtration System:

1. Turn off power to the Furnace.
2. Disconnect the exhaust hose from the Furnace and remove the outer metal cap.
3. Remove the four screws holding the blower and remove the blower assembly. (TIP: Chances are pretty good that there will be an accumulation of soot up there, so have the vacuum cleaner handy!) Vacuum out the vanes in the blower.
4. Remove the eight screws holding down the stainless steel plenum chamber and lift chamber off the top of the Furnace. Vacuum everything in sight!
5. Remove the three baffle plates (2 screws each), and vacuum them. Also remove the five ceramic tubes and clean them with a brush/vacuum cleaner. Replace when clean.
6. Reassemble upper filtration system and run scale lift diagnosis as above.
7. The exhaust stack also should be cleaned at this time.

(The entire filter cleaning operation should appropriately thirty minutes.)

Lubricating The Blower Motor:

There are two rubber plugs on the motor with small holes in the center of each plug. *Remove* the plugs and insert about 10-20 drops of synthetic lubricant such as ANDEROLL 465 in each bearing. DO NOT OVER-OIL AND DO NOT USE PETROLEUM BASED PRODUCTS.

Other Items:

Check that the following furnace components are operating in accordance with the manufacturer's written directions.

1. Pay particular attention to the operation of the door locking system and that the lock device and limit switch is properly adjusted.
2. Door seal: check for condition of seal and air tightness.
3. Filter gaskets: check for condition and proper fit.
4. Heating elements.

Weekly Lifts Checks:

A copy of the Ignition Furnace Equipment Verification Record shall be available for each furnace showing the weekly lift checks. The lift is to be checked by the operator every fifth day of operation preferably on a Monday morning prior to starting the furnace. Period when the unit is not in operation should be noted on the record.

Transporting Ignition Furnaces Fixed In A Mobile Laboratory:

Before a mobile laboratory containing an ignition furnace is moved the furnace must be secured. The furnace must be firmly attached to the counter top or placed on the floor of the mobile laboratory. The internal balance must be secured for transportation. See the manufactures instructions. For the NCAT furnaces with a Setra or Ohaus balance at a minimum the carbide hearth tray and the support tubes will be removed and safely stored before the furnace and /or the mobile laboratory is moved.

Balance Inspection:

If a mobile laboratory or a fixed site is being used for housing an ignition furnace and the furnace has been transported to that site the balance must be inspected. The support tubes and carbide hearth tray must be placed back into the furnace.
Open the furnace door. Insert the four support tubes through the tube ports located in the bottom of the furnace chamber. The tubes should seat on the appropriate pins on the balance plate. The support tubes should not be in contact with the sides of the tube ports. If any of the support tubes will not seat on the appropriate pins or are rubbing on the side of the tube port the balance has moved during transport and must be adjusted. See manufactures instructions.
Once the support tubes are in place, place the carbide hearth tray on the tubes. Center the hearth tray on the four tubes, equal distance from side to side.

Internal Balance Verification of calibration:

Verification of the internal balance calibration is required every 30 days when the furnace is in use and after any transport or movement of the ignition furnace. This is in addition to the required annual balance calibration by a commercial calibration company.

A copy of the Ignition Furnace Equipment Verification Record shall be available for each furnace showing internal balance verifications.

Identify the type of internal balance in the ignition furnace (typically Setra or Ohaus).

1. The furnace must be COLD before verifying its internal scale; however the balance must be on for at least 20 minutes prior to verification. This can be done by leaving the chamber door open with the furnace on.
2. Insert a paper or cloth for the weights to set on, re-zero the balance.
3. Place the 4000 gram weight as close to the center of the silicon carbide hearth tray as possible.
4. Record the reading and verify the reading is within ± 0.05% (2.0 grams).
5. Place the other 4000 gram weight on the scale with both weights as close to the center of the silicon carbide hearth tray as possible.
6. Record the reading and verify the reading is within ± 0.05% (4.0 grams).

If both readings are within the limits, the internal balance is within specifications. If either reading is not within the limits, then the internal balance cannot be used until it is serviced by a certified commercial company.

External Balance Verification of calibration:

Verification of the external balance is required at the same time with the internal balance verification.

1. Place a paper or cloth for the weights to set on, re-zero the balance. Place the 4000 gram weight as close to the center of the silicon carbide hearth tray as possible.
2. Record the reading and verify the reading is within ± 0.05% (2.0 grams).
3. Place the other 4000 gram weight on the scale with both weights as close to the center of the silicon carbide hearth tray as possible.
4. Record the reading and verify the reading is within ± 0.05% (4.0 grams).

If both readings are within the limits, the external balance is within specifications. If either reading is not within the limits, then an external balance that meets the requirements must be provided.

Ignition Furnace Equipment Standardization Record

Standardization Procedure: ITD-NCAT1 Standardization Frequency: As noted

Ignition Furnace Ident No.	Furnace Manufacturer:	Internal Balance Manufacturer:	External Balance Ident No.

Verification		Air Flow Rate	Cleaning?	Internal Balance		Disposition of Internal Balance		External Balance		Disposition	
Date	By	Range: -3.5g to -10g	Yes or No	4000 ± 2.0 g	8000 ± 4.0 g	Within Specs	Out of Specs (use external balance)	4000 ± 2.0 g	8000 ± 4.0 g	Within Specs	Out of Specs
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								
			☐Y ☐N								

Procedure No. ITD-D21

Procedure For Standardizing Maximum Specific Gravity Bowls

AASHTO T209, ASTM D240

Standardization Equipment Required:

1. Balance with "below the scale" weighing for gravity baths, capable of weighing to nearest 0. I g.
2. Thermometer capable of reading to nearest 0. 1'.

Tolerance:

Bowl mass recorded to nearest 0. I g.

Procedure:

1. Fill gravity bath and wait until water level overflow has stopped.
2. Bring water temperature to 25 ± 0.1 OC.
3. Determine the mass of the bowl dry in air and record, as mass in air.
4. Suspend bowl in water to a depth sufficient to cover the entire bowl.
5. When all overflow water has stopped record the weight of the bowl as weight in water.
6. Perform these determinations at least twice with the difference between any two determinations not exceeding 0.1 grams.

Maximum Theoretical Specific Gravity Standardization Record

Standardization Reference: ITD D21 Standardization Frequency: 12 months

Date of Standardization:

Vacuum Container:		
Type	Standardization Date:	Ident No.:
Calibration / Standardization Standards:	Balance Ident Number	
	Thermometer Ident Number:	
	Residual Pressure Manometer Make: Model No:	

Vacuum Container Standardization Data:

Bowl No.	Water Temperature, Cº	Dry Reading Mass of Bowl	Immersed Reading Weight of Bowl

Vacuum Pump System

Measured residual pressure (25-30mm of Hg or less)-_____mm Hg

Satisfactory - ☐ Yes ☐ No

Remarks:

Standardized by:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

Procedure No.: ITD-D20

Bituminous Concrete Specimen Plungers, Followers, Shims, Supports And Round Rod Check

Equipment Checked:

Plungers, followers, shims, supports, round rod. (AASHTO T167, T245, T247).

Purpose:

To check the critical dimensions of Compressive Strength and Hveem. plungers, followers, shims, supports and round rod.

Inspection Equipment Required:

1. Micrometer readable to 0.01 mm.

Tolerance:

The critical dimensions shall meet the applicable method(s).

Procedure:

1. Measure and record the outside diameter to nearest 0.01 mm.
2. Rotate 90 degrees (1/4 turn) and repeat step I.
3. Where height measurement is required repeat steps I and 2.

Check Record for Plungers, Followers, Supports, Shims and Rods

Check Procedure: ITD-D20 | Check Frequency: 12 Months

Date of Check: | Micrometer No.:

Item	Measurements		Within Tolerances	Action Taken
Leveling Load	**Diameter, mm**	**Height, mm**	**Diameter 101.09 to 101.31 mm**	
Follower: Height 140.0 mm			Yes☐ No☐	
Follower: Height 38.1 mm			Yes☐ No☐	
Stabilometer	**Diameter, mm**	**Height, mm**	**Diameter 101.47 to 101.73 mm** **Height 140.0 mm**	
Calibration Follower			Yes☐ No☐	
Immersion Compression	**Diameter, in.**	**Height, in.**	**Followers, Diameter 4.000 in.** **Plungers, Height 2 +/- 1/8 in.** **Supports 25.4 mm**	
Follower #1			Yes☐ No☐	
Follower #2			Yes☐ No☐	
Plunger #1			Yes☐ No☐	
Plunger #2			Yes☐ No☐	
Support #1			Yes☐ No☐	
Support #2			Yes☐ No☐	
Miscellaneous	**Diameter, MM**	**Length, MM**	**Rod Diameter 9.5 mm** **Rod Length 406.0 mm** **Shims 6.4 x 19 X 64 mm**	
Round Nose Rod			Yes☐ No☐	
Steel Shims, Hveem Stability			Yes☐ No☐	
			Yes☐ No☐	

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE- CHECK DUE DATE:**

Procedure No. ITD D-18

Vacuum Systems Standardization

Equipment Checked:

Vacuum Systems (AASHTO T100, T209) (ASTM D854, D2041)

Inspection Equipment Required;

1. Standardized absolute pressure gauge.
2. Water vapor trap.
3. Hoses, connectors, tools etc.

Tolerance:

Vacuum systems shall be capable of applying and maintaining the vacuum specified in the applicable test method.

Procedure:

1. Connect the standardized vacuum gauge to the system with the trap in-line between the system and the standardized gauge.
2. Make sure all connections are air tight.
3. Apply a vacuum to the number of vessels normally used in testing. Read and record the pressure indicated on the calibrated vacuum gauge.

Vacuum System Standardization Record

Standardization Procedure: ITD-D18 Standardization Frequency: 12 months

Date of Standardization:	
Standardization equipment:	Serial No.
Reading Hg psig	
Action recommended: ☐ None ☐ Repair ☐ Replace	

Remarks:	
Standardized by:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE- STANDARDIZATION DUE DATE:**

Procedure: ITD-D19

Bituminous Concrete or Immersion-Compression, Hveem, R-Value Specimen Molds Check

AASHTO T167, T247, T246 – ASTM D1074, D1561

Inspection Equipment Required:

Calipers capable of measuring the inside diameter and readable to 0.01mm.

Tolerance:

The diameter of the molds checked must meet the dimensional tolerances specified in the test methods referenced above.

Procedure:

1. Measure and record the inside diameter of the mold to the nearest 0.01mm. Rotate the mold 90 degrees (1/4 turn) and measure and record the inside diameter again.
2. Turn the mold over and repeat step 1.

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Immersion / Compression Molds

(Four (4) inch molds)

Check Procedure: ITD-D19 Check Frequency: 12 months

Date of Check:

Mold No.	Inside Diameter Reading Top		Inside Diameter Reading Bottom		Acceptable
	Reading No. 1	Reading No. 2	Reading No. 1	Reading No. 2	
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐

Tolerance: 101.60 mm to 101.73 mm Maximum Height

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Hveem Molds

(Four (4) inch molds)

Check Procedure: ITD-D19 Check Frequency: 12 months

Date of Check:

Mold No.	Inside Diameter Reading Top		Inside Diameter Reading Bottom		Acceptable
	Reading No. 1	Reading No. 2	Reading No. 1	Reading No. 2	
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐
					Yes☐ No☐

Tolerance: 101.47mm to 101.73mm Maximum Height: 5 in. (127mm)

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Soil (R-Value) Molds

Check Procedure: ITD-D19 Check Frequency: 12 months

Date of Check:

Mold No.	Inside Diameter Reading Top		Inside Diameter Reading Bottom		Action
	Reading No. 1	Reading No. 2	Reading No. 1	Reading No. 2	

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Procedure: IT-15 ITD-B26

Saybolt Viscometers Standardization

Inspection Equipment Required:

1. Oil standard, minimum efflux time of 90 seconds.
2. Bath maintained at 50C. ± 0.05C. (122 F. ± 0.10 F.)
3. Thermometer, Type ASTM 19C
4. Timer

Tolerance:

Tolerances can be found in AASHTO T-72 section 9.4

Procedure:

1. Establish and control the bath temperature at the selected test temperature of 50C. ± 0.05 C. (122 F. ± 0.10 F.)
2. Insert a cork stopper into the air chamber at the bottom of the viscometer a small chain or cord may be attached to the cork to facilitate rapid removal. The cork shall fit tightly enough to prevent the escape of air, as evidenced by the absence of oil on the cork when it is withdrawn later as described.
3. Stir the sample in the viscometer with the appropriate viscosity thermometer equipped with the thermometer support (T-72 Fig.3). Use a circular motion at 30 to 50 rpm in a horizontal plane.
4. When the sample temperature remains constant within 0.05C. (0.100F.) of the test temperature during one minute of continuous stirring, remove the thermometer.
5. Immediately place the tip of the withdrawal tube in the gallery at one point, and apply suction to remove oil until its level in the gallery is below the overflow rim with the withdrawal tube.
6. Check to be sure that the receiving flask is in proper position: then snap the cork from the viscometer and start the timer at the same instant.
7. Stop the timer the instant the bottom of the oil meniscus reaches the graduation mark on the receiving flask.
8. Record the efflux time in seconds to the nearest 0.1 second.
9. The certified Saybolt viscosity of the standard shall equal the measured efflux time at 50 C. (122 F). If the efflux time differs from the certified value by more than 0.2%, calculate a correction factor, F, for the viscometer as follows:

$$F=V/t$$

V = certified Saybolt viscosity of the standard.

t = measured efflux time at 50 C. (122 F.)

Saybolt Viscometer Standardization Record

Standardization Procedure: ITD-B26 Calibration Frequency: 36 months

Saybolt Viscometer Ident No. Serial No.:			Standardization Date:	
Standardization equipment and serial numbers				
19°C (122°F.) Thermometer:		Standard Type:		Standardization Temperature
Lot #:	Expiration date:		Viscosity. Of Standard At Standardization Temperature:	

Orifice No.	Reading #1	Reading #2	Reading #3	**Average**	Date Of Replacement	New Constants

Remarks:	
Standardized by:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

Procedure: ITD-B24

Asphalt Constant Temperature Baths, Water or Oil Calibration

Inspection Equipment Required:

1. A standardized thermometer that reads to 0.1°F. (0.06°C)

Tolerance: Constant temperature baths shall be maintained at:

1. Penetration Bath (Water) 77°F. (25°C.) ± 0.2°F. (0.1°C.)
2. Absolute Viscosity Bath (Oil) 140°F. (60°C.) ± 0.05°F. (0.03°C.)
3. 140F. Kinematic Bath (Oil) 140°F. (60°C.) ±0.10°F. (0.06°C)
4. 275F. Kinematic Bath (Oil) 275°F. (135°C.) ± 0.10°F. (0.06°C)
5. Saybolt Furol Viscosity Bath (Oil) 77°F. (25°C.) ±- 0.10°F. (0.05°C.)
6. Saybolt Furol Viscosity Bath (Oil) 122°F. (50°C.) 0.10°F. (0.05°C.)

Procedure:

1. Place the standardized thermometer or temperature probe next to the thermometer in the water or oil bath.
2. Allow the thermometer to stabilize, and compare temperatures on thermometers. This temperature should reflect the same reading. If they do not, make note of the difference on the work sheet.
3. Adjust thermo regulator as needed so that temperature fluctuates equal distances above and below the desired temperature.
4. Record temperature range of bath.

Verification of Calibration for Asphalt Constant Temperature Bath, Water or Oil

Verification Reference: ITD-B24 Verification Frequency: 12 months

Identification Number:	Date Calibrated:
Bath Type (water, air, oil):	Calibration Standard: Thermometer Ident Number:
ASTM (there are different test methods depending on type of bath):	Required temperature range :_
Is the bath of the proper size and type as required by the specification? :	☐Yes ☐No

After the bath is brought to the desired temperature, take successive readings at equally spaced intervals over the immersion time specified by the test method. Record readings in the following table.

Bath Temperature Readings				Specified Test Temperature	Acceptable Yes/No
1	2	3	4		

Bath Disposition:	☐ Acceptable ☐ Unacceptable

Remarks:

Calibrated By:	Signature:
WAQTC NO.	
PREVIOUS CALIBRATION DATE:	**RE-CALIBRATION DUE DATE:**

Verification Procedure ITD-D42

Moisture Density (Proctor) Mold Check

AASHTO T 99-10 Sec. 3.1 - 3.1.3
AASHTO T180-10 Sec. 3.1- 3.13

Check Equipment Required:

Calipers, readable to 0.01 mm.
Scales, readable to .01 lbs.

Procedure:

1. The molds shall be solid-wall metal cylinders manufactured to the dimensions shown below. They shall have a detachable collar assembly approximately 60 mm (2.375 in) in height, to permit the preparation of compacted specimens of soil-water mixtures of the desired height and volume. The mold and collar assembly shall be so constructed that it can be fastened firmly to a detachable base plate made of the same material. The base plate shall be plane to 0.005 in.
2. Record measurements verifying height, diameter, and planeness are within tolerances.
3. With a clean mold, determine the mass of the mold and baseplate without the collar. Record the mass of the mold and baseplate. Verify that the new mass is the same as the mass written on the mold.

Volume Determination:

1. Mold can be determined either in a dry state or by following AASHTO T 19.
2. Determination of the mold volume in the dry state:
    a. Measure and record the inside diameter of the mold to the nearest 0.01mm. Rotate the mold 90 degrees (1/4 turn) and measure and record the inside diameter again.
    a. Turn the mold over and repeat step 1
    b. Average all 4 readings
    c. Measure and record the height of the mold to the nearest 0.01mm. Rotate the mold 180˚, measure and record each height
    d. Average the 2 readings.
    e. Calculate the volume
3. Determination of mold volume per AASHTO T 19
    a. Perform the steps in the “Calibration of Measure” section.
    b. This volume determination will require creating a water tight seal between the mold and the base plate with a small amount of petroleum jelly, silicon grease. Another method is by applying plumbers putty to the outside of the mold to create that seal. Make sure the dry mass determination is taken with the sealing product applied.
4. Record the volume of the mold in cubic feet and write the volume of the mold on the side of the mold.

4" Moisture Density (Proctor) Mold Standardization Record

Standardization Procedure: ITD-D42 Standardization Frequency: 12 months

Identification Number:	Date Standardized:
Manufacturer:	
Calibration Standard: Caliper No:	**New** Mold Tolerances: Inside Diameter 101.19 to 102.01 Height 116.27 to 116.53 **Used** Mold Tolerances: Inside Diameter 100.99 to 102.21 Height 116.27 to 116.53

DIMENSIONAL DATA: ☐ As Found

	Inside Diameter - Top, in.	Inside Diameter - Bottom, in.	Inside Height - in.
Measurement #1			
Measurement #2	(90˚)	(90˚)	(180˚)
AVERAGE	D_t=	D_b=	H=

New Mold :	☐ Used Mold:	☐ No
Mold Average Inside Diameter within tolerance :	☐Yes	☐ No
Mold Average Inside Height within tolerance :	☐ Yes	☐ No
Disposition of Mold:	☐ Acceptable	☐ Not Acceptable
Calculated Volume of Mold:		

Remarks:

Standardized By:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

6" Moisture Density (Proctor) Mold Standardization Record

Standardization Procedure: ITD-D42 Standardization Frequency: 12 months

Identification Number:	Date Standardized:
Manufacturer:	
Calibration Standard: Caliper No:	**New** Mold Tolerances: Inside Diameter 151.74 to 153.06 Height 116.30 to 116.56 **Used** Mold Tolerances: Inside Diameter 151.41 to 153.39 Height 116.30 to 116.56

DIMENSIONAL DATA: ☐ As Found

	Inside Diameter - Top, in.	Inside Diameter - Bottom, in.	Inside Height - in.
Measurement #1			
Measurement #2	90˚	90˚	180˚
AVERAGE	D_t=	D_b=	H=

New Mold ☐	Used Mold ☐	
Mold Average Inside Diameter within tolerance?	☐Yes	☐ No
Mold Average Inside Height within tolerance?	☐ Yes	☐ No
Disposition of Mold:	☐ Acceptable	☐ Not Acceptable
Calculated Mold Volume:		

Remarks:

Standardized By:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

Procedure ITD-D40

Moisture Density (Proctor) Manual Rammer Check

AASHTO T 99 Sec. 3.2.1 (5.5 lb)

OR

AASHTO T 180 Sec. 3.2.1 (10 lb)

Inspection Equipment Required:

1. Calipers readable to 0.0 I mm
2. Tape measure readable to 1\16 in.
3. Scale, capacity of 20.000 grams. readable to I.0 grams.

Tolerance:

Equipment shall meet the dimensional tolerances specified in AASHTO T 99 sec. 3.2. 1. Equipment shall meet the dimensional tolerances specified in AASHTO T 180 sec. 3.2. 1.

Procedure:

1. Using the calipers measure the diameter of the rammer face by taking 2 readings 90 degrees apart.
2. Extend the rammer, measure the drop of the rammer from its highest stopping point to the bottom lip of the sleeve.
3. Remove the rammer from the sleeve by unscrewing the nut on the handle.
4. Weigh the rammer along with the nut, washers and handle.
5. Using the calipers, measure the diameter of the vent holes on the top and the bottom.
6. Measure the distance of the vent holes from the top and the bottom lips (to the center of the holes).

Procedure : ITD-D40

5.5lb Manual Rammer Check Record

Check Procedure: ITD-D40 ☐ Check Frequency: 12 months

Identification Number:	Date Checked:
Manufacturer:	
Calibration Standards: Caliper Number: Balance Number:	

DIMENSIONAL DATA: ☐As Found ☐As Adjusted

	Measurement #1	Measurement#2		ASTM REQUIREMENTS
Rammer Circular Face Diameter: mm				50.55 to 51.05 mm
Rammer Weight: grams				2486 to 2504 g
Rammer Height of Drop: mm				303 to 307 mm

Guide sleeve holes: min dia, 9.5 mm:				
TOP	#1	#2	#3	#4
BOTTOM	#1	#2	#3	#4
Guide sleeve holes: distance from end of sleeve: 18 to 20 mm				
TOP	#1	#2	#3	#4
BOTTOM	#1	#2	#3	#4

Disposition of Rammer: ☐ Acceptable ☐ Not Acceptable

Remarks:

Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECKED DATE:	**RE-CHECKED DUE DATE:**

10.0lb Manual Rammer Standardization Record

Standardization Procedure: ITD-D40 ☐ Standardization Frequency: 12 months

Identification Number:	Date Standardized:
Manufacturer:	Rammer: Nominal Weight: Nominal Drop:
Calibration Standards:	Caliper Number: Balance Number:

DIMENSIONAL DATA: ☐As Found ☐As Adjusted

	Measurement #1	Measurement#2		ASTM REQUIREMENTS
Rammer Circular Face Diameter:				50.55 to 51.05 mm
Rammer Weight:				4527 to 4545 g
Rammer Height of Drop:				455 to 459 mm

Guide sleeve holes: min dia, 9.5 mm:				
TOP	#1	#2	#3	#4
BOTTOM	#1	#2	#3	#4
Guide sleeve holes: distance from end of sleeve: 18 to 20 mm				
TOP	#1	#2	#3	#4
BOTTOM	#1	#2	#3	#4

Disposition of Rammer: ☐ Acceptable ☐ Not Acceptable

Remarks:

Standardized By:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

Procedure: ITD-D6

Specific Gravity T-84 Mold &Tamper Check

Purpose:

To check the critical dimensions of the sand cone and tamper

Inspection Equipment Required:

1. Calipers or ruler readable to I mm.
2. Balance or scale readable to 0.1g.
3. Steel Rule.

Tolerance:

Equipment shall meet the dimensional tolerances specified AASHTO T84.

Procedure:

1. Measure and record the inside diameter at the top of the cone to the nearest I mm by taking two readings 90' apart.
2. Measure and record the inside diameter at the bottom of the cone to the nearest I mm by taking two readings 90'apart.
3. Place the cone on a flat surface. Measure and record the depth of the cone by using the calipers and a straight-edge.
4. Measure and record the thickness of the cone to the nearest I mm by taking 2 readings 90 ' apart at the top of the cone and two readings at the bottom of the cone 90' apart.
5. Measure and record the diameter of the tamping face to the nearest I mm by taking two readings 90 ' apart using the calipers.
6. Determine the mass of the tamper to the nearest 0. I, g.

Specific Gravity Mold & Tamper Check

Check Procedure: ITD-D-6 Check Frequency: 12 (mos.)

Identification No:	Manufacturer:	
Check Standards:	Caliper	Ident#
	Balance	Ident#
	Rule Graduations	mm

Check Results: ☐ As Found ☐ As Adjusted

	#1	#2	#3	ASTM Requirement
Thickness of Cone Walls (mm)				0.8mm min.

	#1	#2	ASTM Requirements
Cone Inside Diameter (mm) Top			37 to 43 mm
Cone Inside Diameter (mm) Bottom			87 to 93 mm

	#1	#2	#3	ASTM Requirement
Cone Height (mm)				72 to 78 mm

	#1	#2	ASTM Requirements
Tamper Weight (g)			325 to 355g
Diameter of Tamping Face (mm)			22 to 28 mm

Equipment disposition: ☐ Acceptable ☐ Not Acceptable

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Procedure ITD-D39

Liquid Limit Device and Grooving Tool Check

(AASHTO T-89, ASTM D-4318)

Purpose:

To provide instructions for checking the liquid limit device, grooving tool and cup.

Inspection Equipment Required:

1. Balance, 2000g, readable to 0.1g
2. 7" calipers, readable to 0.0001"
3. Stopwatch, readable to 0.1sec.

Tolerance:

As found in the test methods listed above.

Procedure:

1. Measure and record the thickness of the brass cup.
2. Weigh and record the weight of the brass cup.
3. Measure and record the dimensions of the L.L. base.
4. Measure the worn spot if any, where the cup contacts the base.
5. If electric, check the drop rate of two drops per minute.
6. With calipers, measure and record the dimensions of the grooving tool and gage end.

Liquid Limit Device And Grooving Tool Check

Check Procedure: AASHTO T-89 (year) Check Frequency: 12 (months)

Identification No.:		Date Checked:
Manufacturer:	Model No:	Manufacturer Serial No.:
Standard Used: Caliper Ident Number:		Balance Ident Number:

Liquid Limit Device**:**

Essential Dimension	A	B	C	N	K	L	M
Reading (mm)	Per Manuf.						
ASTM Tolerance	54 ±5	2 ±0.1	27 ±1.0	47 ±1.5	50±2.0	150±2.0	125±2.0

Grooving Tool:

Essential Dimension	A	B	c	d	e
Reading (mm)					
ASTM Tolerance	10 ±0.1	2 ±0.1	13.5 ±0.1	10 ±0.2	15.9

Mass of Cup: _____g, (Range per ASTM - D-4318: 185 to 215g)

Disposition of Equipment: ☐ Satisfactory ☐ Unsatisfactory

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Procedure ITD-D37

Procedure For Soils Pycnometer Standardization

(AASHTO T-100)

Purpose:

1. To provide a temperature correction chart for the Pycnometer filled with distilled water.
2. To verify the Pycnometer's mass.

Inspection Equipment Required:

1. Standardized Thermometer.
2. Balance capable of weighing 2000 g. readable to 0.01 g.

Tolerance:

Tolerances shall meet AASTHO T-100 7.1 and 7.2

Procedure:

1. Determine and record the clean dry mass of the Pycnometer to the nearest .01 g.
2. Fill the Pycnometer with distilled water at or near room temperature. Fill to the mark on the neck of the Pycnometer with the ***center*** (bottom) of the meniscus just touching the line.
3. Determine and record the mass of the Pycnometer to the nearest .01 g.
4. Allow Pycnometer + water to stabilize. Use a rubber stopper with a hole in its center so as to allow the thermometer to read the temperature at the mid-point of the distilled water. Record the temperature.
5. Complete a chart for the different temperatures likely to occur while testing in the Lab. Use sections 7.1 and 7.2 to calculate each Pycnometer's temperature/mass.

Soil Pycnometer Standardization Report

Standardization Procedure: ITD-D37 Standardization Frequency: 12 months

Pycnometer Number	Dry Weight (Wf)	Weight with Water (Wa)	Temperature of Water, Cº (Ti)	Relative Density of Water	Correction Factor (k)	Corrected Weight

Remarks:	
Standardized by:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

Check Procedure: ITD-DI

L.A Wear Abrasion Machine Check

(AASHTO T-96)

Purpose:

To check the critical dimensions and general operating condition of the L.A. machine and the mass of the spheres; used as test charges.

Tolerance:

The L.A. machine shall meet the dimensional tolerances specified along with the steel spheres used to charge the machine shall meet the mass tolerances specified in the applicable test method listed above and shall be in good operating condition.

Inspection Equipment Required:

1. Steel rule readable to 1 mm
2. Stopwatch readable to 0.1 sec.
3. Balance with a 5 kg capacity, readable to 1 g.

Procedure:

1. Measure and record the inside diameter of the drum to the nearest 1 mm.
2. Measure and record the inside Length to the nearest 1 mm.
3. Measure and record the wall thickness at the left and right edges to the nearest 1 mm
4. Is the cylinder horizontal?
5. Measure and record the shelf width inside the drum to the nearest 1 mm.
6. Measure and record the distance from the shelf to the opening in the direction of rotation.
7. Record the RPM to the nearest number over a 5 minute period.
8. Check and record the number of revolutions.
9. Weigh and record the individual spheres to the nearest 1 g.
10. Record the total weight of spheres for a "B" wear to the nearest 1g.

L.A. Abrasion Check Record

Check Procedure: MTI-CAL-34, ASTM-C131- _____ (year) Check Frequency 24 (months)

ITD Identification No.	Manufacturer:
Model No.	Manufacturer Serial No
Check Standard used:	ITD Balance No
	ITD Caliper No

Drum horizontal within a tolerance of 1 in 100: ☐Satisfactory ☐Unsatisfactory

Shelf width measures 3.5 in. ±0.1 in. ☐Satisfactory ☐Unsatisfactory

Shelf is firm, rigid and straight ☐Satisfactory ☐Unsatisfactory

Shelf surface is flat with no ridge greater than 0.1 in. ☐Satisfactory ☐Unsatisfactory

Machine has uniform peripheral speed ☐Satisfactory ☐Unsatisfactory

L.A. Rattler Charge (Steel Sphere), see worksheet pg.2 ☐Satisfactory ☐Unsatisfactory

Drum Dimensions:

	Measurements (Inches)				ASTM Tolerance	Acceptable Yes/No
	1	2	3	Average		
Inside Diameter					28" ±0.2"	
Inside Length					20" ±0.2"	

Revolutions:

Revolutions per minute				ASTM Tolerance	Acceptable Yes/No
1	2	3	Average		
				30 to 33 RPM	

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

L.A. Abrasion Charge (Steel Sphere) Check

Check Procedure: ASTM-C131- _____ (year) Check Frequency: 24 (months)

Check Standard used: ITD Balance No. _____ ITD Caliper No._____	Date of Check:

Sphere Number	Diameter Readings (inches)				Weight Grams	Acceptable(390g -445g) Yes/No
	1	2	3	Average		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Charge Based on Grading**:**

Grading	Number of Spheres	Sphere No. in Group	Total Weight Grams	ASTM Tolerance Grams	Acceptable Yes/No
A	12			5000 ±25	
B	11			4584 ±25	
C	8			3330 ±20	
D	6			2500 ±15	

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Standardization Procedure: ITD-D41

Mechanical Soil Compactor (Proctor Mechanical Rammer) Standardization

AASHTO T-99 Section 3.2.2 & 3.2.3, AASHTO T-180 Section 3.2.2 & 3.2.3, ASTM D2168

General Equipment Inspection:

Thoroughly inspect the mechanical and manual compactors for evidence of wear, malfunction, and need of servicing and adjustment. Clean, adjust, and lubricate the compactors so as to meet all requirements of the manufacturer, and the applicable method under which they will be used and for which the mechanical compactor is to be calibrated. Operate the compactor for a minimum of 25 drops to cause friction in the parts to become constant, allowing the rammer to fall on soil or other soft material.

Inspection Equipment Required:

1. Calipers readable to 0.01 mm
2. Tape measure readable to 1\16 in.
3. Straight edge, readable to 1\16 in.
4. Scale, capacity of 20,000 grams, readable to .1 grams.

Inspection Tolerance:

Equipment shall meet the dimensional tolerances specified in AASHTO T 99 sec. 3.2.2 for the 5.5 lb. Rammer. The 10 lb. Rammer shall meet the specifications found in AASHTO T-180, sec. 3.2.2.

Inspection Procedure for the 5.5 lb. Rammer:

1. Open the mechanical rammer housing and remove the rammer from its holder.
2. Using the calipers measure the diameter of the rammer face by taking 2 readings 90 degrees apart.
3. Weigh the rammer and then replace the rammer to its operating position.
4. Measure the drop height of the rammer by using the following method:
   a. Remove the rammer resting plate and lower the rammer onto a pad that will not compact.
   b. Measure from the top of the rammer 12 inches and place a temporary mark on one of the guide rods.
   c. Set the unit to cycle for 1 drop. Take a straight edge and place it slightly above the temporary mark on the guild rod. Cycle the rammer once while observing where the ram stops at its high point. Move the position of the straight edge to correspond with this high point. Recycle the rammer and adjust your straight edge until you have an accurate releasing point of the rammer.
   d. Place a second temporary mark on the guild rod at this point.

e. With the rammer setting on the cushioned pad, measure from the top of the rammer to the second mark to achieve the actual drop height.

Inspection Procedure for the 10 lb. Rammer:

The 10 lb. Rammer procedure is the same except section 4b, which should read 18 inches.

Standardization Procedure:

1. Prepare two 5-point moisture density curves according to AASHTO T99 using a 5.5 pound manual rammer for one curve and the mechanical 5.5 lb. rammer for the other curve. Record the maximum unit weight of each curve.
2. Obtain the percent of difference (*W*) in the two curves by dividing the mechanical (Y^1) maximum unit weight by the manual (Y) unit weight.
3. If the absolute value of *W* is equal to or less than 2.0, the mechanical compactor is satisfactory for immediate use.
   a. If the absolute value of *W* is greater than 2.0, then obtain two additional sets of data. Use the same soil sample used previously. Determine *W*, the average percentage difference of maximum dry unit mass values for three sets of data. If the absolute value of *W* is equal to or less than 2.0, the mechanical compactor is satisfactory for immediate use.
   b. If the absolute value of *W* is greater than 2.0, then adjust the rammer mass of the mechanical compactor according to ASTM D2168 and obtain sets of three new values and compute a new value for *W* until the value is within the tolerance.

Mechanical Soil Compactor Standardization

Standardization Procedure: ASTM-D-2168 ______(year) Method A Standardization Frequency: 12 months

Identification No:	Date Standardized
Manufacturer:	Model No:
Mfg. Serial No:	Shape of Rammer Face:
Weight of Rammer:	Accuracy Requirement: 2.0% maximum % difference in max. unit weight
Calibration Balance Number:	Standardization Data ☐ As found ☐As Adjusted

Trial Number	Max. Unit Weight Manual Method(Y max.)	Max. Unit Weight Mechanical Method(Y' max.)	% Difference in Max. Unit Weight
1			(g)
2			
3			
AVERAGE			(W)*

* If first Trial is within tolerance enter NA in these spaces. If not in tolerance, run 2 more Trials and compute AVG. % difference of all 3. If AVG. is out of tolerance adjust and run 3 more Trials and determine AVG.

NOTE: Attach work sheet for ASTM-D-698 or D-1557 data used in this Standardization procedure.

Compactor Disposition: ☐ Acceptable ☐Not Acceptable	
Remarks:	
Standardized by:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE**:

Procedure No. ITD-S 105

Concrete Slump Cone Check

AASHTO T 119

Inspection Equipment Required:

A measuring tape or ruler, 45 0 mm (I 8 ") minimum length.

Procedure:

1. The mold shall be made clean and free of foreign material.
2. The thickness of the metal from which the mold is made shall not be less than 1. 14 min (0.045"), at any measured point.
3. Measure the top of the mold, it should read 102 mm (4") in diameter.
4. Measure the bottom of the mold, it should read 203 mm. (8") in diameter.
5. Measure the height of the mold, it should read 305 mm (12").

Tolerances:

Individual diameters and heights shall be within +/- 3.2 mm (1/8") of the specified dimensions.

Slump Cone Check Record

Check Procedure: ITD-S105 Check Frequency:12 months

Identification No.:	Date Checked:
Equipment Description:Slump Cone Manufacturer: ☐ Seamless ☐ With Seam	
Standard Used: Caliper Number	Steel Rule: Gradations:
Check Results: ☐ As Found ☐ As Adjusted	

Dimensional Check Results

Thickness of Cone Walls	Reading #1	Reading #2	Reading #3	AASHTO Requirements
Top				0.045" min.
Bottom				0.045" min.

Inside Diameter	Reading #1	Reading #2	Reading #3	AASHTO Requirements
Top				3-7/8" to 4-1/8"
Bottom				7-7/8" to 8-1/8"

Cone Height	Reading #1	Reading #2	Reading #3	AASHTO Requirements
				11-7/8" to 12-1/8"

Disposition of Cone: ☐ Acceptable ☐ Not Acceptable	
Remarks:	
Checked By:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Procedure: ITD-S108

Constant Temperature Bath Concrete and Cement specimens Standardization

Inspection Equipment Required:

1. A standardized thermometer that reads to 0.1°F. (0.06°C)

Tolerance: Concrete and Cement Specimens (water), Baths shall be maintained at 73.5º F ± 3.5º F (23.0 ± 2.0ºC).

Procedure:

1. Place the standardized thermometer or temperature probe next to the thermometer in the water bath.
2. Allow the thermometer to stabilize, and compare temperatures on thermometers This temperature should reflect the same reading. If they do not, make note of the difference on the work sheet.
4. Adjust thermo regulator as needed so that temperature fluctuates equal distances above and below the desired temperature.
5. Curculation divice(s) must keep the water at the required temperature throughout the bath.
6. Record temperature range of bath.

Constant Temperature Bath Concrete and Cement Specimen Calibration

Calibration Reference: ITD-S-108 Calibration Frequency: 6 months

Identification Number:	Date Calibrated:
Bath Type (water, air, oil):	Calibration Standard: Thermometer Number:
ASTM (test method determined by type of bath):	Required temperature range :_
Is the bath of the proper size and type as required by the specification? :	☐Yes ☐No

After the bath is brought to the desired temperature, take successive readings at equally spaced intervals over the immersion time specified by the test method. Record readings in the following table.

Bath Temperature Readings				Specified Test Temperature	Acceptable Yes/No
1	2	3	4		

Bath Disposition:	☐ Acceptable ☐ Unacceptable

Remarks:

Calibrated By:	Signature:
WAQTC NO.	
PREVIOUS CALIBRATION DATE:	**RE-CALIBRATION DUE DATE:**

Standardization Procedure: ITD-D10

Unit Weight Bucket Standardization

AASHTO T-19

Inspection Equipment Required:

1. A standardized thermometer.
2. A calibrated balance readable to 5 grams (.01 lbs)
3. A glass plate of at least 6 mm thick and 25 mm larger than the diameter of the measure.
4. A feeler gage of 0.25 mm.

Tolerance:

Measure shall comply within the standards set in AASHTO T-19

Procedure:

1. Record the serial number of the equipment to be tested.
2. Determine if the top of the rim is satisfactorily plane by using a 0.25mm feeler gage and the glass plate placed on top of the measure. The feeler gage must not be capable of being inserted between the rim of the measure and the glass plate.
3. Determine the mass of the dry measure and the glass plate. (W_1)
4. Fill the measure with water at a temperature between 60 – 85 F and cover with the glass plate in such a way as to eliminate bubbles and excess water.
5. Wipe the outside of the measure and glass plate dry being careful not to lose any water from the measure.
6. Determine the mass of the measure, glass plate and water.(W_2)
7. Determine the mass of the water in the measure by subtracting the mass in Step 3 from the mass in Step 6.
8. Perform steps 3 through 6 a minimum of two times with the mass difference between any two determinations being .3 grams.
9. Measure and record the temperature of the water.
10. Determine and record water density (D) from Table 2 in WAQTC FOP AASHTO T121, interpolating as necessary.
11. Calculate and record the volume (V) of the measure by dividing the mass of the water by the density of the water at the measured temperature.

Unit Weight Measure (Bucket) Standardization Record

Standardization Procedure: ITD-D10 Standardization Frequency: 12 months

Identification Number:	Date Standardized:
Nominal Capacity of Measure ($ft.^3$)	Standardization Data: ☐As Found ☐As Adjusted
Standards Used: Balance ITD Number:	Thermometer ITD Number:
1. Top Rim Planeness (0.01" or 0.25mm): ☐Acceptable	☐Not Acceptable
2. Volumetric Calibration	
1. Mass of Measure + Glass Plate: W_1=	2. Mass of Measure + Glass Plate + Water: W_2=
3. Temperature of Water: T= ☐°F ☐°C	4. Density of Water from Table 2 @ T: D=
5. Mass of Measure + Glass Plate: W_1=	6. Mass of Measure + Glass Plate + Water: W_2=
7. Temperature of Water: T= ☐°F ☐°C	8. Density of Water from Table 2 @ T: D=
9. Volume Calculations:	$V= [(W_2 - W_1)/D]=$
Remarks:	
Standardized By:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

Standardization Procedure: ITD-B-22

Thermometer Standardization

Purpose:

To provide instructions for standardization of thermometers.

Inspection Equipment Required:

1. A Certified Thermometer for specific temperature.
2. Temperature Bath.
3. Ice Bath.
4. Magnifying glass with light.

Tolerance:

Tolerances can be found in ASTM E-1 Table 2.

Procedure for Single Point Operation Thermometer:

1. Visually examine thermometer to be verified for separation, glass faults, etc.
2. Properly immerse both the certified thermometer and the thermometer being verified in a temperature bath maintained at test temperature. Thermometers should be placed within approximately one inch of each other and allowed time enough to stabilize (Approximately 5 minutes).
3. Read and record temperature of both thermometers.
4. Calculate difference between the two thermometers. Compare the difference to the scale error value as noted in ASTM E-1 Table 2.
5. If the difference is outside the scale error maximum, repeat this procedure two more times and reject thermometer if difference remains outside of scale error maximum.

Procedure for Multi-Point Thermometer:

1. Visually examine thermometer to be verified for separation, glass faults, etc.
2. Thermometer will be verified at two temperature points, the Ice Point and the Maximum Operation Temperature Point. (The Maximum Operation Temperature Point is defined as the highest temperature the thermometer will be used at to conduct testing.)
   (a) Perform Ice Point test as provided in ASTM E-77 to obtain first testing point.
   (b) Maximum Operation Temperature Point. Place both the certified thermometer and the thermometer being verified into the appropriate temperature bath. Adjust the bath temperature to the testing point. The thermometers shall be placed within one inch of each other, immersed to the specified level in the bath, and allowed to stabilize. (Approximately 5 minutes)
3. Read and record temperature of both thermometers.
4. Calculate difference between the two thermometers. Compare the difference to the scale error value as noted in ASTM E-1 Table 2.
5. If the difference is outside the scale error maximum, repeat this procedure two more times and reject thermometer if difference remains out of scale error maximum.

Procedure for Standardized Thermometers:

1. Visually examine thermometer to be verified for separation, glass faults, etc.
2. Perform Ice Point test as provided in ASTM E-77.
3. Standardized thermometer temperature reading should equal temperature recorded on the “Certificate of Calibration” (If Ice Point reading varies more than one division with the certified reading, thermometer should be replaced.

Thermometer or Temperature Recorder Standardization Record

Standardization Procedure: ASTM-E-77-_____ (year) Standardization Frequency: 12-6 months

Identification Number:	Date Standardized:
Equipment Description:	
Thermometer Type:	Temperature Recorder Type:
Manufacturer:	Model No:
Mfg. Serial No:	
Full Range of Equipment: _____ to _____,	Graduations:
Accuracy Requirement:	Standard Used: Type: ITD Number:
☐Full Range ☐Working Range (identify):	Calibration Data: ☐As Found ☐As Adjusted

Section I

(1) Standard	(2) Equipment	(3) Standard*	(4) Equipment	(5) Standard*	Equipment Avg.	Standard Avg.	Error

* Avg. of (1) & (5) must agree with (3), if not repeat until agreement is obtained.

Section II	
Ice Point: Equipment: Error= Not Applicable	
Section III	
Single Point Liquid-in-Glass Thermometer Calibrations Only	
Date of Initial Complete Range Calibration: Not Applicable	Equipment Disposition: ☐Acceptable ☐Not Acceptable
Remarks:	
Standardized by: WAQTC NO.	Signature:
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

Pressure Type Concrete Air Meter Standardization

References: AASHTO T152, Procedure No. ITD-S102

Inspection Equipment Required:

1) General purpose scale, 2) Glass plate, 3) Grease 4) Small flat screwdriver

Procedure:

1. Determine and record the mass of the base of the pressure meter and the glass plate together (W_1)
2. Apply a small amount of grease on the lip of the base and fill to the top with water. Carefully place the glass plate on top of the base removing excess water and being careful not to trap air under the plate. Slide as necessary. Wipe excess water from base and plate.
3. Determine and record the mass of the base, water, and glass plate together (W_2)
4. Subtract the mass of step I from the mass of step 3. This figure is the mass of water of the base (M)
5. Determine and record the mass of the 5% vessel, which comes with the pressure meter(m1)
6. Fill the vessel to the top with water, determine and record mass on worksheet.(m2)
7. Subtract the mass of Step 5 from the mass of Step 6 (m)
8. Determine R by dividing m by M times 100. R should equal 5%.
9. Next, screw the short piece of straight tubing into the threaded petcock hole on the underside of the cover. Clamp cover on the base with the tube extending down into the water.
10. With petcocks open, use the squeeze bulb and add water through the petcock with the pipe extension attached below, until all air is forced out of the opposite petcock.
11. Leaving both petcocks open, pump up air pressure to a point just beyond the pre-determined initial pressure line (IP). Wait a few seconds for the compressed air to cool to normal temperature and then stabilize the gauge needle at the proper initial pressure line by pumping or bleeding off as needed.
12. Close both petcocks and immediately press down on the thumb lever exhausting air into the base. Wait a few seconds until the needle is fully stabilized. At this point, if all the air was eliminated, and the initial pressure line was correctly selected, the gauge should read 0%. If two or more consecutive tests show a consistent result that differs from the 0%, then change the initial pressure to compensate for the variation. Use the newly established initial pressure for subsequent tests.
13. Once the initial pressure is established and 0% air is achieved, then screw the curved tube into the outer end of the petcock which has the pipe extension attached below. Turn the nozzle in the downward position. Take the 5% calibrating vessel, (354 ml), which comes with the gauge and hold it under the nozzle of the tube, carefully press down on the thumb lever and control water flow with the petcock. Fill the vessel with water from the base. Do not overflow the vessel.
14. Open the free petcock and release the air. Open the other petcock and allow the water to run back into the base from the curved tube. There is now 5% air in the base.
15. With petcocks open, pump the air pressure up again in the exact same manner as described in step 12. Close petcocks and immediately press the thumb lever. Wait a few seconds for the exhaust air to warm to normal temperature and for the needle to stabilize. The dial should now read 5% (A).
16. If two or more tests show consistent readings that differ from the 5% in excess of 0.2%, then remove gauge glass and reset the dial needle to 5% by turning the calibration screw located just below and to the right of the dial center.
17. When the gauge needle reads correctly at 5%, then additional water may be removed in the same manner as in step 15, to check results at 10%, 15%, and 20%, etc.

Pressure Type Concrete Air Meter Standardization Record

Standardization Procedure: ITD-S102 Standardization Frequency: 3 months

Meter Identification Number:		Date Standardized:
Manufacturer:		Type:
Mfg. Serial No:	Model No:	Size:
Calibration Balance Number:		Calibration Vessel Number:
Standardization Data: ☐ As Found		☐ As Adjusted
STANDARDIZATION VESSEL		
Mass of Measure + Glass Plate: W_1=_____		Mass of Measure + Glass Plate + Water: W_2=_____
Mass of Water in Vessel (m) m1 = mass Vessel = _____ m2 = mass Vessel + Water = _____ m = m2 – m1 = _____		Mass. of Water in Measure (M) M = (W2) - (W1) = _____
Calculation of R: R = m / M x 100 _____ %		
TYPE B METERS		
Air Content Standard (R) = _____%		Initial Pressure (IP) per manufacturer or as determined = _____
Air Content Reading of Meter (A) = _____%		Meter Error (A-R) = _____%
Disposition of Meter: ☐ Acceptable ☐ Maintenance Required		

Remarks:	
Standardized by:	Signature:
WAQTC NO.	
PREVIOUS STANDARDIZATION DATE:	**RE-STANDARDIZATION DUE DATE:**

Procedure No. ITD-S 1 04

CAPPING COMPOUND Check

AASHTO T23 1, ASTM C617

Purpose:

To check / verify the strength of sulphur capping compound. Sulphur compounds shall have a minimum compressive strength of 34 MPa, (5,000 psi).

Inspection Equipment Required:

1. Cube mold and base plate conforming to AASHTO T106
2. Metal cover plate conforming in principal to the design shown in Fig. 1, of AASHTO T231
3. Mineral oil
4. Brush
5. Sulphur capping compound
6. Sulphur capping compound heating pot
7. Metal ladle
8. Meal spoon
9. Medium size flat blade screwdriver
10. Medium slip joint pliers

Procedure:

1. With the brush, put a light coat of mineral oil on the mold surfaces which will be in contact with the capping material. Put the mold assembly together and let it come to room temperature, 20 to 30 C, (68 to 86 F).
2. Using a sulphur heating pot, bring the temperature of the capping material to within a range of 129 to 143 C, (265 to 290 F). At this temperature molten sulphur compound readily segregates, so using the metal spoon, stir the pot thoroughly before each use.
3. With the metal ladle, quickly fill each of the three mold compartments until the molten material reaches the top of the filling hole. Allow sufficient time for maximum shrinkage due to cooling and solidification, approximately 15 minutes, then refill each hole with molten material
4. After solidification is complete, remove the cubes from the mold without breaking off the knob formed by the filling hole. Remove oil, fins, and sharp edges which may have formed during the casting process.
5. Check the planeness of the bearing surfaces in the manner described in AASHTO T106. After storage at room temperature for two (2) hours, test cubes in compression following the procedure described in AASHTO T 1 06 and calculate the compressive strength in megapascals, (pounds per square inch).

Capping Compound Check Record

Check Procedure: ITD-S104 Check Frequency: 12 months

Reference: AASHTO T231, Section 4

Equipment Ident No.	Check Date:
Check Equipment	
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.

Size of Cubes			
Width, inches			
Depth, inches			
Area, square inches			
Max Load, lbs			
Compressive Str, psi			
Average, psi		5,000 psi minimum	
Temperature of material		265 F to 290 F	

Name and Type of Capping Compound: _____

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Procedure No. ITD-S 107

CYLINDER CAPPING MOLDS Check

AASHTO T23 1, ASTM C617

Purpose:

To check the planeness of cylinder capping molds.

Inspection Equipment Needed:

1. Straight Edge
2. Feeler Gauge 0.002" (0.05 mm)
3. Calipers readable to 0.0001"

Procedure:

1. Lay the straight edge across the face of the capping mold.
2. Try to fit the 0.002" (0.05 mm) feeler gauge between the straight edge and the face of the capping mold.
3. The feeler gauge should not slide in. If the gauge goes in, the mold will have to be machined until a planeness of less than 0.002" (0.05 mm) is achieved.
4. Repeat this procedure for the other plate.
5. Measure the diameter of the plate with the calipers. It should be I" greater in diameter than the specimen. The plate should be at least 1/2" thick.
6. Report the results on the report form.

Tolerances:

All capping plates, when new, shall not depart from plane by more than 0.05mm (0.002") in any 6" of diameter. Used plates should be free of gouges and groves greater than 0.010" deep or 0.05 sq. in. in surface area.

Cylinder Capping Molds Check

Check Procedure: ITD-S107 Check Frequency: 12 months

Reference: AASHTO T231, ASTM C617

Equipment Ident No.	Check Date:
Check Equipment	
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.

	Machined metal plate is at least ½ in. thick	Plate is 1 in. greater in diameter than specimen	Surface does not depart from plane more than 0.002 in. in 6 in.	Surface is free of grooves or indentations
2 in				
2 in				
2 in				
3 in				
4 in				
4 in				
4 in				
6 in				
6 in				

Action Recommended: ☐Repair ☐Replace ☐No Action

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Procedure No. ITD-S I 03

BEARING BLOCKS Check

AASHTO T 106, ASTM C 109

Purpose:

To check the planeness of bearing blocks.

Inspection Equipment Needed:

1. Straight Edge
2. Feeler Gauge 0.00 I'' (0.025 mm)

Procedure

1. Lay straight edge across the face of upper bearing block.
2. Try to fit the 0.00 I '' (0. 025 mm) feeler gauge between the straight edge and the face of the bearing block.
3. The feeler gauge should not slide in. If the gauge goes in. the block will have to be machined until a planeness of less than 0.001'' (0.025 mm) is achieved.
4. Repeat this procedure for the bottom block.
5. Report the results on the report form.

Tolerances

All bearing blocks, when new, shall not depart from plane by more than 0.013) mm (0.0005'') and they shall be maintained at 0.025 mm (0-00 I''). If the bearing block is larger than 6'' in diameter, they shall be maintained at 0.025 mm (0.001'') in any 6'' of diameter.

Bearing Blocks Check

Check Procedure: ITD-S103 Check Frequency: 12 months

Reference: AASHTO T106 & ASTM C39

<table>
<tr><td>Equipment Ident No.</td><td>Check Date:</td></tr>
<tr><td colspan="2">Check Equipment</td></tr>
<tr><td>Type:</td><td>Ident No. or Serial No.</td></tr>
<tr><td>Type:</td><td>Ident No. or Serial No.</td></tr>
<tr><td>Type:</td><td>Ident No. or Serial No.</td></tr>
<tr><td>Type:</td><td>Ident No. or Serial No.</td></tr>
</table>

<table>
<tr><td>Machine Capacity</td><td rowspan="2">Top Readings</td><td rowspan="2">No. 1</td><td rowspan="2">No. 2</td><td rowspan="2">No. 3</td><td rowspan="2">No. 4</td><td rowspan="2">No.5</td><td colspan="3">Action</td></tr>
<tr><td rowspan="7">Test Machine Size:</td><td>Repair</td><td>Replace</td><td>None</td></tr>
<tr><td>Pass</td><td></td><td></td><td></td><td></td><td></td><td rowspan="2">☐</td><td rowspan="2">☐</td><td rowspan="2">☐</td></tr>
<tr><td>Fail</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="9"></td></tr>
<tr><td>Bottom Readings</td><td>No. 1</td><td>No. 2</td><td>No. 3</td><td>No. 4</td><td>No.5</td><td rowspan="3">☐</td><td rowspan="3">☐</td><td rowspan="3">☐</td></tr>
<tr><td>Pass</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Fail</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Remarks:

<table>
<tr><td>Checked by:</td><td rowspan="2">Signature:</td></tr>
<tr><td>WAQTC NO.</td></tr>
<tr><td>PREVIOUS CHECK DATE:</td><td>RE-CHECK DUE DATE:</td></tr>
</table>

Cube Mold (2" X 2") Check Record

Check Procedure: ASTM-C-109-_____ (year) Check Frequency: 12 month

Mold Identification Number:	Check Date:
Check Standard: Type:	Serial No:
Accuracy Requirements for Molds:	(a) Planeness: 0.002" maximum deviation
	(b) Opposite Face Dimension: 1.98" to 2.02"
	(c) Height: 1.985" to 2.01"
Condition of Molds: ☐Acceptable ☐Unacceptable	

Compartment Number	Planeness*	Opposite Face Dimension		Height Avg.
		Position #1	Position #2	
1	☐S ☐U			
2	☐S ☐U			
3	☐S ☐U			

* S - Satisfactory U = Unsatisfactory

NOTE: Assure that each cube mold half is matched with the corresponding half (i.e., by serial number) before performing verification check.

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE**:

Concrete Capping Stand Check Record

Check Procedure: ASTM-C-617-_____(year) Check Frequency: 12 (Months)

Equipment Ident No.	Check Date:
Check Equipment	
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.

VERIFICATION ITEMS	**Results ***
1. General Condition	☐S ☐U
2. Perpendicularity of alignment bars (1/8" in 12", max.)	☐S ☐U
3. Bottom Plate Thickness (½" min.)	☐S ☐U
4. Cap To Specimen Center (1/16" max. deviation)	☐S ☐U

* Indicate: S - For Satisfactory; U - For Unsatisfactory

Capping Stand Disposition: ☐ Acceptable ☐ Not Acceptable

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Unbonded Cap Retaining Ring Check Record

Check Requirements: ASTM-C-1231-_____year)   Check Frequency: 12 Months

Equipment Ident No.	Check Date:
Check Equipment	
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.

	VERIFICATION ITEMS	Results *
1.	General Condition	☐S ☐U
2.	Inside diameter measures between 102% and 107% of the diameter of the cylinder.	☐S ☐U
3.	Planeness of surfaces (within ± 0.002") that contact Bearing Blocks	☐S ☐U
4.	Bearing surfaces of the retainers shall have no gouges, grooves or indentations > 0.010 in. deep or > 0.05 in.^{2} in surface area	☐S ☐U

* Indicate: S - For Satisfactory; U - For Unsatisfactory

Retainer Ring Disposition: ☐ Acceptable ☐ Not Acceptable

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

Unbonded Cap Check Record

Check Requirements: ASTM-C-1231-_____year) Check Frequency: 12 Months

Equipment Ident No.	Check Date:
Check Equipment	
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.
Type:	Ident No. or Serial No.

	CHECK ITEMS	Results *
1.	Unbonded Cap(s) indicate Manufactures / Suppliers name, Shore hardness, applicable concrete compressive strength data	☐S ☐U
2.	Documentation / records indicating the date caps were put into service, cap hardness / durometer, number of tests(1).	☐S ☐U

(1) Maximum number of tests per set of caps: 100.

* Indicate: S - For Satisfactory; U - For Unsatisfactory

Unbonded cap Disposition: ☐ Acceptable ☐ Not Acceptable

Remarks:	
Checked by:	Signature:
WAQTC NO.	
PREVIOUS CHECK DATE:	**RE-CHECK DUE DATE:**

SECTION 300.00 – ITD HQ CENTRAL LABORATORY

SECTION 350.00 ASPHALT LABORATORY

SECTION 360.00 STRUCTURES & CEMENT LABORATORY

SECTION 300.00 – ITD HQ CENTRAL LABORATORY

The first formal testing of materials for Idaho highways took place at the University of Idaho in Moscow, Idaho in 1919. Later, as the need expanded, a small laboratory was set up in the basement of the Capitol Building in Boise in 1926. This laboratory operated until 1939 when a Central Laboratory building was built at 27th and Main Streets in Boise. In 1971 the Central Laboratory moved to the present location at 3293 Jordan Street in Boise.

The HQ Central Laboratory is comprised of separate laboratory units that perform specific laboratory tests. Refer to each section for a description of the laboratory unit and its function as follows:

- Aggregate-Asphalt Mix Laboratory Section 310.00
- Soils Laboratory Section 320.00
- Geotechnical Laboratory Section 330.00
- Chemistry Laboratory Section 340.00
- Asphalt Laboratory Section 350.00
- Structures and Cement Laboratory Section 360.00

300.01 Evaluation of Testing Technicians.

Laboratory Coordinators are responsible to arrange schedules with appropriate proctors to evaluate the testing technicians annually. The evaluations are part of the overall HQ Central Laboratory Quality Control Program.

SECTION 310.00 AGGREGATE & ASPHALT MIX LABORATORIES

The Aggregate and Asphalt Mix Laboratories use approved testing procedures to provide consistent and reliable information to evaluate aggregate and asphalt mix materials. The information is used to determine the suitability of the material for use in highway construction and compliance to design specifications.

The Aggregate Laboratory and the Asphalt Mix Laboratory are AASHTO accredited.

All materials received must be tested in accordance with the specifications of the awarded contract for each project. If no contract has been awarded, testing will be performed according to the requirements of the ITD Standard Specifications for Highway Construction.

310.01 Referenced Documents.

State of Idaho Contract and Plans (per project)

Idaho Transportation Department Standard Specifications for Highway Construction

AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing

ASTM Standards

Western Alliance for Quality Transportation Construction (WAQTC) sampling, testing and inspection manual(s)

Idaho Transportation Department Laboratory Operations Manual

Idaho Transportation Department Quality Assurance Manual

310.02 Aggregate Laboratory.

The Aggregate Laboratory is responsible for the quality analysis of aggregates submitted for use in state of Idaho highway projects. Aggregates submitted are primarily tested for the following:

- Quality
- Establishing the need and quantity, if any, for anti-stripping additive for asphalt used in mix designs (Immersion Compression)
- Establishing the compaction target for aggregate base and granular borrow
- The strength of compacted base and granular borrow materials (R-Value)

310.02.01 Testing Requirements.

The following categories of test methods are performed by the Aggregate Laboratory.

- Sample Preparation: Sieving, splitting, and makeup.
- Aggregate Quality: Sieve Analysis, L. A. Wear, Idaho Degradation, Sand Equivalent, Ethylene Glycol and, when requested, Soundness of Aggregate.
- Immersion Compression (Aggregate Portion): Sieve Analysis, Fracture Count, Sand Equivalent, Uncompacted Voids in Fine Aggregate, and specific Gravity of Coarse and Fine Aggregate.
- Compaction: Vibratory Compaction, Standard Compaction (Moisture Density), Sieve Analysis, Specific Gravity and Sand Equivalent, and Surface Area.
- Strength of Compacted Base and Granular Borrow: R-Value, Sieve Analysis, Specific Gravity, and Sand Equivalent.
- Miscellaneous Testing: Cleanness of Cover Coat Aggregate and Loose Unit Weight, Aggregate Specific Gravity using CoreLok.

310.02.02 Test Methods.

The following list provides the AASHTO or ASTM designation for each test method performed.

AASHTO T 11	Materials Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing
AASHTO T 19	Unit Weight and Voids in Aggregate
AASHTO T 27	Sieve Analysis of Fine and Coarse Aggregates
AASHTO T 84	Specific Gravity and Absorption of Fine Aggregate
AASHTO T 85	Specific Gravity and Absorption of Coarse Aggregate
AASHTO T 96	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
AASHTO T 176	Plastic fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
AASHTO T 248	Reducing Samples of Aggregate to Testing Size
AASHTO T 304	Uncompacted Void Content of Fine Aggregate
AASHTO T 335	Fracture Count
IDAHO IT-15	Idaho Degradation
IDAHO IT-72	Cleanness of Cover Coat Material
IDAHO IT-74	Vibratory Spring-Load Compaction for Coarse Granular Material
IDAHO IT-116	Ethylene Glycol
IDAHO IT-144	Specific Gravity and Absorption of Fine Aggregate Using Automatic Vacuum Sealing (CoreLok) Method

310.03 Asphalt Mix Laboratory.

The Asphalt Mix Laboratory is responsible for the quality analysis of bituminous mixtures submitted for use in state of Idaho highway projects. Materials are primarily tested for:

- Establishing the need and quantity, if any, for anti-stripping additive for asphalt used in mix designs (Immersion Compression).
- Compliance of asphalt mix to specification(s). (Current production.)
- Investigating mix properties of previously produced and placed asphalt mix. (From the existing roadway.)

310.03.01 Testing Requirements.

The following categories of test methods are performed by the Asphalt Mix Laboratory.

- Sample Preparation: Heating, mixing, and splitting.
- Plant Mix and Cold Mix Testing and Immersion Compression: Superpave Gyratory Compaction, Rut depth using Asphalt Pavement Analyzer, Hveem Stability, Maximum Specific Gravity (Rice Method), Bulk Specific Gravity, Density, Voids in Mineral Aggregate, Mix Air Voids, Effective Asphalt Content, Asphalt Film Thickness, and Effects of Moisture.
- Plant Mix Produced at the Job Site and Cores Extracted from the Roadway: Asphalt Content, Sieve Analysis, Maximum Specific Gravity (Rice Method), Bulk Specific Gravity, Mix Air Voids, Density, and Hveem Stability.

310.03.02 Test Methods.

The following list provides the AASHTO or ASTM designation for each test method performed.

AASHTO T 30	Mechanical Analysis of Extracted Aggregate
AASHTO T 165	Effect of Water on Cohesion of Compacted Bituminous Mixtures
AASHTO T 166	Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
AASHTO T 167	Compressive Strength Bituminous Mixtures
AASHTO T 182	Coating and Stripping of Bitumen-Aggregate Mixtures
AASHTO T 209	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
AASHTO T 246	Resistance to deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus
AASHTO T 247	Preparation of Test Specimens of Bituminous Mixtures by Means of California Kneading Compactor
AASHTO T 248	Reducing Samples of Aggregate to Testing Size
AASHTO T 269	Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
AASHTO R-47	Reducing Samples of Hot Mix Asphalt (HMA) to Testing Size
AASHTO T 308	Standard Test Method for Determining the Asphalt Content of Hot Mix Asphalt (HMA) by the Ignition Method
AASHTO T 312	Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of Superpave Gyratory Compactor
Idaho IR-125	Acceptance Test Strip for Plant Mix Pavement

310.04 Inspection and Equipment Certification of Satellite Laboratories.

Once per year, personnel from the HQ Central Laboratory will qualify satellite laboratories located in each of ITD's districts. The District Laboratories must meet the requirements according to the ITD Laboratory Qualification Program. See Section 200.

SECTION 320.00 SOIL LABORATORY

The Soil Laboratory tests the physical properties of soil samples that are submitted by the districts. Test results are employed mainly for design during project development and sometimes for quality assurance during construction.

The Soil Laboratory also performs tests on soil samples that are not related to project development or quality assurance, such as samples from research projects, from other state agencies, and from American Materials Reference Laboratories (AMRL).

320.01 Preparation of Soil Samples.
The soil sample is prepared according to AASHTO T 87. After the sample is properly dried and the material is reduced to its natural state, a sample is broken out for each individual test.

320.02 Testing of Soil Samples.
After the samples have been prepared, a worksheet is created for recording test data. As the tests are completed, the information is entered into the Soil database from these worksheets. Calculations are then performed and results are plotted if required. Upon each test's completion, a computer-generated worksheet is printed and used to prepare the Final Report.

320.03 Soil Tests.
The following list provides the AASHTO or ASTM designation for each test method performed as well as the sample size required.

Test	AASHTO, ASTM or Idaho Test Method	
Moisture/Density Relations	T 99, T 180	
Moisture Content of Soils	T 265	
Liquid Limit	T 89	
Plastic Limit & Plasticity Index	T 90	
Soil Classification	ASTM D2487	
	AASHTO M 145	
R-Value (Stability)	IT-8	
Particle Size Analysis	T 88	
Specific Gravity (Fine)	T 100	
Resistivity	T 288	
pH	T 289	
Gradation (Sieve Analysis)	T 27, T 11	

Test	AASHTO, ASTM or Idaho Test Method	
Permeability of Granular Soils	T 215	
Chloride and Sulfate		
Resilient Modulus	T 307	
Organic Content	T 267	
Soil Permeability	ASTM D2434	

320.04 Tests Performed by the Soil Laboratory for the Aggregate Laboratory.
Some of the Aggregate Laboratory tests require an R-Value and a Specific Gravity for fine-grained materials. The Aggregate Laboratory Technicians will break out the samples according to their procedures and deliver the sample to Soil Laboratory for testing. The test results are logged in the Soil Laboratory database and a copy of the tests results are delivered to the Aggregate Laboratory.

SECTION 330.00 GEOTECHNICAL LABORATORY

The Geotechnical Laboratory performs tests to determine physical and mechanical properties of undisturbed soil samples (and disturbed soil samples in some cases) and rock cores submitted by the districts.

The Geotechnical Laboratory also performs tests on geotextiles and geogrids, mostly for quality assurance during project construction. Testing is sometimes performed for other purposes, such as for research projects.

The Quality Assurance Engineer or Geotechnical Engineer should be consulted for determining the types of test that are needed for each project.

330.01 Preparation of Samples.

Most of the soil samples submitted to the Geotechnical Laboratory are undisturbed ring samples, Shelby tubes, or block samples. Shelby tubes or block samples will be trimmed to the required sizes for testing. Disturbed soil samples are sometimes received by the laboratory and in these cases; remolded samples are created in the lab for testing. Rock cores are normally submitted for strength tests and they are cut to the properly size for testing. Geotextile or geogrid samples are cut to sizes needed for different tests.

330.02 Testing of Samples.

All tests are performed according to the test methods listed in the next section and the instructions of the Quality Assurance Engineer or Geotechnical Engineer.

330.03 Geotechnical Tests.

The following list provides the AASHTO or ASTM designation for each test method performed.

Test	AASHTO, ASTM, COE, and ISRM Test Method
Consolidation	T 216
Triaxial Compression	T 296 & T 297
Direct Shear	T 236
Unconfined Compressive Strength	T 208
Rock Point	ASTM D5731
Resilient Modulus	T 307
Rock Point Load Test	ISRM (International Society for Rock Mechanics)
Geotextile -Trapezoidal Tear Strength	ASTM D4533

Test	AASHTO, ASTM, COE, and ISRM Test Method
Geotextile – Grab Tensile Strength	ASTM D4632
Geotextile – Grab Elongation	ASTM D4632
Geotextile - Puncture Strength	ASTM D6241
Geotextile – Wide Width Tensile Strength	ASTM D4595
Geotextile – Permittivity	ASTM D4491
Geogrid – Tensile Strength	ASTM D6637
Geogrid – Tensile Modulus	ASTM D6637
Geogrid – Apparent Opening Size	COE- CW-02215

330.10 Geotextiles, Geogrids and Geosynthetics.

When verification test results indicate the material does not meet the required specifications for a specific lot, a price adjustment will be applied as shown in the table below.

The price adjustments will accumulate for each property that does not meet the specification, however, if more than two properties are out of specifications, the geotextile or geogrid of that specific lot will be rejected. When one property is more than 40% out of specification, the geotextile or geogrid will also be rejected.

PRICE REDUCTION SCHEDULE FOR GEOSYNTHETIC MATERIALS

GEOTEXTILES

Property	Test Method	Price Reduction	REMARKS
Grab Tensile Strength	ASTM D 4632	The amount of the price adjustment is equal to the percentage difference of the test result and the specification limit.	Minimum Price Reduction is 10%
Grab Elongation	ASTM D 4632	Price adjustment is one-half of the percentage difference of the test result and the specification limit.	
Puncture Strength	ASTM D 6241	The amount of the price adjustment is equal to the percentage difference of the test result and the specification limit.	Minimum Price Reduction is 10%
Trapezoidal Tear Strength	ASTM D 4533	The amount of the price adjustment is equal to the percentage difference of the test result and the specification limit.	Minimum Price Reduction is 10%
Apparent Opening Size (AOS)	ASTM D 4751	Price adjustment is one-half of the percentage difference of the test result and the specification limit.	
Permittivity	ASTM D 4491	The amount of the price adjustment is equal to the percentage difference of the test result and the specification limit.	Minimum Price Reduction is 10%
Asphalt Retention	ASTM D 6140	The amount of the price adjustment is equal to the percentage difference of the test result and the specification limit.	Minimum Price Reduction is 10%
Ultraviolet (UV) Radiation Stability Retained	ASTM D 4355	Price adjustment is one-half of the percentage difference of the test result and the specification limit.	

GEOGRIDS

Property	Test Method	Price Reduction	REMARKS
Aperture Size Range	No test Method. Calipers are used.	Price adjustment is one-half of the percentage difference between the test result and the specification limit.	
Open Area	COE CW-02215	Price adjustment is one-half of the percentage difference between the test result and the specification limit.	
Tensile Strength	ASTM D6637	The amount of the price adjustment is equal to the percentage difference of the test result and the specification limit.	Minimum Price Reduction is 10%
Junction Strength	GRI-GG2 (2000) (not tested at ITD)	The amount of the price adjustment is equal to the percentage difference of the test result and the specification limit.	Minimum Price Reduction is 10% (not applied)

SECTION 340.00 CHEMISTRY LABORATORY

The Central Materials Chemistry Laboratory's responsibility is to provide accurate, reliable, and consistent chemical and physical analyses of a wide variety of materials used in the construction and maintenance of the highways. Primarily the Chemistry Laboratory work includes:

- To monitor submitted samples of materials for ITD specification compliance in both Quality Control and Quality Assurance Programs.
- To develop the Qualified Product List for selected materials used by ITD.
- To conduct analyses and evaluations on project related Quality Assurance samples, and submitted samples for award of statewide contracts.

Materials tested include traffic line paint, glass beads, anti-icing and deicing chemicals, pavement markings, cement, fly ash, etc.

The Chemistry Laboratory is accredited by the American Association for State Highway and Transportation Officials (AASHTO) for cement analysis. The laboratory participates in the sample proficiency programs with the Cement and Concrete Reference Laboratory (CCRL) and the American Materials Reference Laboratory (AMRL) through AASHTO. The Chemistry Laboratory maintains an internal Quality Control/Quality Assurance program. The Chemistry Laboratory provides a consultative service for select materials used in ITD projects. The Chemistry Laboratory conducts research on new products and testing procedures. Research results are evaluated for either compliance to existing specifications or for implementation in future specifications. The Chemistry Laboratory also generates new specifications for developing materials.

340.01 Reference Documents.

AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing

American Standards of Testing and Materials (ASTM)

Idaho Transportation Department Standard Specifications for Highway Construction .

Special Provisions from ITD contracts (SP)

Standard Special Provisions (SSP)

Steel Structures Painting Council Specifications and Test Methods (SSPC)

United States Federal Specifications and Test Methods (FSTM)

United States Military Specifications and Test Methods (Mil Specs)

Idaho Test Methods (IT)

ITD Quality Assurance Manual

Society of Automotive Engineers Manuals (SAE)

Handbook of Lubrication Engineering

Idaho Transportation Department Contract and Plans

Standard Methods for the Examination of Water and Wastewater (SM)

National Association of Corrosion Engineers (NACE)

United States Environmental Protection Agency (EPA)

United States Department of Agriculture (USDA) Agricultural Handbook No. 60, Diagnosis and Improvement of Saline and Alkaline Soils Methods.

340.02 Chemistry Laboratory Functions.
Sample frequency for construction and maintenance materials is dictated by the ITD MTRs Section 270 from the Idaho Quality Assurance Manual and/or as documented in ITD contracts. General sample preparation is determined by the individual testing protocol. Testing tolerances for the materials being tested are governed by the Idaho Standard Specifications. Test results must be within the specifications listed unless otherwise noted.

Samples received from a project or contracts are tested as routine or complete samples. Complete testing includes a series of tests as outlined in the next section. Routine testing involves a set of two or more tests. If any problem is found with the routine testing results, the material may then be tested according to the guidelines for complete analysis. Routine and complete testing is performed on materials with continual use throughout the contract year. Testing frequency is determined by the sequence of the samples submitted statewide as control samples. Occasionally, the Chemistry Laboratory will out-source samples requiring specialized testing procedures.

ITD's Preventative Maintenance Oil Analysis Program requires the Chemistry Laboratory to monitor state-owned equipment. As a part of this program, the Chemistry Laboratory performs chemical and physical analyses on used lubricating and hydraulic oils. This includes testing, evaluation, and interpretation of the test data to create a historical trend for the particular component of equipment. The Chemistry Laboratory coordinates with the ITD Maintenance Services Section's Equipment Analyst to make appropriate recommendations for maintenance of the equipment tied to the historical trend data.

340.03 Qualification of Testing Technicians.

The testing technicians are trained and supervised by the Chemistry Laboratory Coordinator who must have at least a bachelor's degree in chemistry. Each testing technician is qualified by annual performance evaluations as part of the laboratory's QC program.

340.04 Out-of-Specification Material.

Material that is determined by laboratory test results as out-of-specification must be removed and replaced unless allowed to remain with a price adjustment as detailed in the following sections. The price adjustment is applied to the invoice price of the material from the supplier to the contractor excluding shipping costs, unless otherwise noted.

340.04.01 Price Adjustment Letter.

A price adjustment letter must be prepared when submitting a test report that includes out-of-specification material. The letter will include only one supplier's failures. Different suppliers, contracts, and contract items will not be used in the same letter.

The letter will be signed by the Chemistry Laboratory Supervisor and accompany the test reports for distribution.

340.05 Testing Requirements.

The following sections describe the various materials tested by the Chemistry Laboratory and the action for out-of-specification material. An asterisk (*) denotes a modification in the specified testing procedure.

340.05.01 Antifreeze.

Sample Frequency: As determined in the ITD contract.

Specifications: FS A-A-52624A Federal Specifications for Antifreeze, Multi-Engine Type

Test Methods:

ASTM D 92	Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D 1119	Standard Test Method for Percent Ash Content of Engine Coolants and Antirusts
ASTM D 1120	Standard Test Method for Boiling Point of Engine Coolants
ASTM D 1121	Standard Test Method for Reserve Alkalinity of Engine Coolants and Antirusts
ASTM D 1122	Standard Test Method for Density or Relative Density of Engine Coolant Concentrates and Engine Coolants By the Hydrometer
ASTM D 1287	Standard Test Method for pH of Engine Coolants and Antirusts
ASTM D 1177	Standard Test Method for Freezing Point of Aqueous Engine Coolants
ASTM D 1881	Standard Test Method for Foaming Tendencies of Engine Coolants in Glassware

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.02 Cement (Portland).

Sample frequency and testing for Subsection 502 Structural Concrete and Subsection 409 Concrete Paving will be according to Section 270 in the ITD Quality Assurance Manual.

For bid schedule item 308 Cement Recycled Asphalt Base Stabilization cement samples, an XRF Scan will be performed for cement type.

Specifications:

AASHTO M 85	Standard Specification for Portland Cement

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

AASHTO T 105	Standard Method of Test for Chemical Analysis of Hydraulic Cement
AASHTO T 153	Standard Method of Test for Fineness of Hydraulic Cement by Air Permeability Apparatus
ASTM C 114	Standard Test Methods for Chemical Analysis of Hydraulic Cement

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with acceptable material. If product cannot be returned the following price adjustment for Total Alkali Content is recommended:

Total Alkali Content (Percent):

Total Alkali Content (Maximum of 0.60%)	Price Adjustment
Less than or equal to 0.62	None
Greater than 0.62 but less than or equal to 0.64	15% of cement used
than 0.64	25% of Contract item quantity

340.05.03 Chloride in Concrete.

Sample Frequency: As requested by the District Materials Engineer

Test Methods:

IDAHO IT-131	Standard Method of Test for Total Chloride Content of Hardened Concrete by Gran Plot Method
AASHTO T 260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials

Noncompliant Material and Price Adjustment: Not applicable.

340.05.04 Curing Compound.

Sample Frequency: According to Section 270 of the ITD Idaho Quality Assurance Manual.

Specifications:

AASHTO M 148	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

AASHTO T 155	Standard Test Method for Water Retention by Concrete Curing Materials
ASTM D 1644	Standard Test Methods for Nonvolatile Content of Varnishes
ASTM D 1475	Standard Test Method for Density of Liquid Coatings, Inks, and Related Products
ASTM E 1347	Standard Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.05 Deicing and Anti-Icing Chemicals.

The following sections give the testing requirements by category.

Sample Frequency: As determined by ITD contract.

Chemical products included are as follows:

Category 1 – Corrosion Inhibited Liquid Magnesium Chloride

Category 2 – Corrosion Inhibited Liquid Calcium Chloride

Category 3 – Non Corrosion Inhibited Liquid Calcium Magnesium Acetate

Category 4A – Corrosion Inhibited Solid Sodium Chloride (Corrosion Percent Effectiveness of 30% or less)

Category 4B – Corrosion Inhibited Solid Sodium Chloride (Corrosion Percent Effectiveness of 31% to 85%)

Category 5 – Corrosion Inhibited Sodium Chloride Plus 10% Magnesium Chloride (Solid)

Category 6 – Corrosion Inhibited Sodium Chloride Plus 20% Magnesium Chloride (Solid)

Category 7 – Calcium Magnesium Acetate (Solid)

Category 8A-B – Non Corrosion Inhibited Sodium Chloride (Standard Gradation, Brining Salt, Insoluble Material less than 1%, and Moisture less than 0.5%)

Category 8A-R – Non Corrosion Inhibited Sodium Chloride (Standard Gradation, Road Salt, Insoluble Material less than 10%, and Moisture less than 0.5%)

Category 8B – Non Corrosion Inhibited Sodium Chloride (Insoluble Material less than 10%, and Moisture less than 5.0%)

Category 8C-B – Non Corrosion Inhibited Sodium Chloride (Fine Gradation, Brining Salt, Insoluble Material less than 1%, and Moisture less than 0.5%)

Category 8C-R – Non Corrosion Inhibited Sodium Chloride (Fine Gradation, Road Salt, Insoluble Material less than 10%, and Moisture less than 0.5%)

Category 9 – Corrosion Inhibited Liquid Sodium Chloride

Category 10 – Corrosion Inhibited Liquid Sodium Chloride Plus Calcium Chloride

Category 11 – Corrosion Inhibited Liquid Chloride Blended Brines

Category – Experimental

Inhibitor Products are as follows:

Category A1 – Corrosion Inhibitor for Sodium Chloride Brine (Minimum 21% NaCl)

Category A2 – Corrosion Inhibitor for Sodium Chloride and Calcium Chloride Brine (Minimum 15% NaCl & 2% CaCl2)

Category A3 – Corrosion Inhibitor for Sodium Chloride (Minimum 15% NaCl)

Specifications:

Pacific Northwest Snowfighters (PNS) and ITD (PNS Website- http://www.wsdot.wa.gov/partners/pns/)

*See Chemistry Central Laboratory Personnel for current Method Procedures

Test Methods:

PNS and ITD	Test Methods and Appendixes
ASTM E 534	Standard Test Methods for Chemical Analysis of Sodium Chloride
ASTM D 632	Standard Specifications for Sodium Chloride
ASTM D 1293	Standard Test Methods for pH of Water
ASTM D 1429	Standard Test Methods for Specific Gravity of Water and Brine
SM 3111A*	Metals by Flame Atomic Absorption Spectrometry
SM 3112B*	Cold-Vapor Atomic Absorption
SM 3125B*	Atomic Absorption
SM 4500-P*	Phosphorus
SM 4500-CN*	Cyanide
NACE TM-0169-95*	Standard Test Method – Laboratory Corrosion Testing of Metals – PNS Modified

Noncompliant Material and Price Adjustment: Statewide contracted material will follow the contract specified price adjustments included with in the contract. For material purchased for use but not under the statewide contract shall follow the terms outlined below.

Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with acceptable material. If product cannot be returned the following price adjustments are recommended as per the contract:

Percent Concentration (Liquid Only)

Bidder Quoted Concentration (BQC)

BQC (25.0% Minimum)	Price Adjustment
	Percent of total shipment or lot number as represented by sample
BQC less 1%	None
25.0% to BQC less 1.1%	25%
24.0% to 24.9%	50%
Less Than 24.0%	100%

Total Metals, Total Phosphorus, and Total Cyanide

Percentage Over the Specified Limit	Price Adjustment
	Percent of total shipment or lot number represented by sample
0% to 5.0%	None
5.1% to 20.0%	15%
20.1% to 40.0%	25%
40.1% to 75.0%	35%
75.1% to 100.0%	50%
Over 100.1%	100%

Percent Corrosion Effectiveness

Samples will be tested against their PNS QPL established Corrosion Effectiveness percentage. Each product will be placed into one of the following ranges based upon their qualified Corrosion Effectiveness value.

Corrosion Effectiveness Ranges
25.0% to 30.0%
20.0% to 24.9%
15.0% to 19.9%
10.0% to 14.9%

5.0% to 9.9%	
Less than 5.0%	

Price adjustments will be taken on material that is more corrosive than it was qualified at according to the following table.

Corrosion Effectiveness Range	Price Adjustment
Percent of total shipment or lot number represented by sample	
1	None
2	50%
3	100% or Rejection

Corrosion Effectiveness (30.0% Maximum)	Price Adjustment
Percent of total shipment or lot number represented by sample	
30.1% to 35.0%	15%
35.1% to 50.0%	50%
Greater than 50.0%	100% or Rejection

Total Settleable Solids (percent by volume)

Settleable Solids (1.0% Maximum)	Price Adjustment
Percent of total shipment or lot number represented by sample	
1.1% to 1.5%	None
1.6% to 3.5%	25%
3.6% to 5.0%	50%
5.1% to 7.5%	75%
Greater than 7.5%	100% or Rejection

Percent Passing No. 10 Sieve (percent by volume)

Percent Passing the No. 10 Sieve (99.0% Minimum)	Price Adjustment
Percent of total shipment or lot number represented by sample	
98.5% to 98.9%	None
98.0% to 98.4%	35%
97.5% to 97.9%	50%
Less than 97.5%	100% or Rejection

Gradations

Gradations outside the following limiting tolerances will be assessed a price adjustment of 10% of the total shipment or lot number as represented by the sample.

Sieve Size	Wt. % Passing	Permissible Variation
3/4"	100%	± 5%
# 4	15% to 100%	± 5%
# 8	5% to 65%	± 5%
# 30	0% to 20%	± 5%

Moisture Content

Category 8A material shall be dried to a maximum moisture content of 0.5% (percent by weight). Water in excess of 0.5% of dry salt weight will not be paid for. The amount of salt to be paid for, when moisture exceeds 0.5% shall be computed as follows:

Pay Weight = (100.5 x Wet Wt. of Salt) divided by (100 + Percent of Moisture)

Category 8B material shall be dried to a maximum moisture content of 5.0% (percent by weight). Water in excess of 5.0% of dry salt weight will not be paid for. The amount of salt to be paid for, when moisture exceeds 5.0% shall be computed as follows:

Pay Weight = (105.0 x Wet Wt. of Salt) divided by (100 + Percent of Moisture)

340.05.06 Dust Abatement – Magnesium Chloride.

Sample Frequency: According to the Idaho Quality Assurance Manual or ITD contract.

Specifications:

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

PNS and ITD	Test Method 1	Appendix A

Noncompliant Material and Price Adjustment: The price adjustments will as shown in the following table.

Contract Specified Concentration

Contract Specified Concentration (28.0% Minimum)	Price Adjustment
Percent of total shipment or lot number represented by sample	
27.5% to 27.9%	None
26.5% to 27.4%	25%
25.5% to 26.4%	50%
Less Than 25.4%	100%

340.05.07 Fencing.

Sample Frequency: According to the Idaho Quality Assurance Manual or ITD Contract.

Sample Testing Tolerance: The laboratory testing tolerance for weight of coatings on galvanized (zinc only) products shall be set at not more than 0.03 oz/ft^2 less the minimum coating requirement for all Classes and Types of fencing materials. All products with a galvanized coating weight less than the minimum coating weight value, including the sample testing tolerance, will be noncompliant material and will not be accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.01 Barbed Wire.

Specifications:

AASHTO M 280 Standard Specification for Metallic-Coated (Carbon) Steel Barbed Wire

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

AASHTO T 65	Standard Method of Test for Mass [Weight] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.02 Chain Link Wire.

Specifications:

AASHTO M 181 Standard Specification for Chain-Link Fence

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

AASHTO T 65	Standard Method of Test for Mass [Weight] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
	Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.03 Gabion Fence.

Specifications:

ASTM A 185 Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

ASTM A 90 Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.04 Gabion Fence Tie Wire and Connecting Wire.

Specifications:

ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

Idaho Transportation Department Standard Specifications for Highway Construction

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.05 Silt Fence.

Specifications:

ASTM A 116 Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric

Idaho Transportation Department Standard Specifications for Highway Construction

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.06 Steel Fence Posts and Assemblies for Woven Wire and Barb Wire Fences.

Specifications:

AASHTO M 281	Standard Specification for Steel Fence Posts and Assemblies, Hot-Wrought

Idaho Transportation Department Standard Specifications for Highway Construction

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.07 Steel Fence Posts or Braces for Chain Link Fences.

Specifications:

AASHTO M 181	Standard Specification for Chain-Link Fence
AASHTO M 281	Standard Specification for Steel Fence Posts and Assemblies, Hot-Wrought
ASTM F 1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

Idaho Transportation Department Standard Specifications for Highway Construction

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.08 Tension Wire and Accessories and Hardware.

Specifications:

AASHTO M 181	Standard Specification for Chain-Link Fence
ASTM A 116	Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

AASHTO T 65	Standard Method of Test for Mass [Weight] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
AASHTO T 68	Standard Method of Test for Tension Testing of Metallic Materials

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.07.09 Woven Wire.

Specifications:

AASHTO M 279	Standard Specification for Metallic-Coated Steel Woven Wire Fence Fabric

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

AASHTO T 65	Standard Method of Test for Mass [Weight] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Material is returned to the manufacturer and replaced with acceptable material. Price adjustments are not in place for this material.

340.05.08 Fly Ash.

Sample Frequency: According to the Idaho Quality Assurance Manual.

Specifications:

AASHTO M 295	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

AASHTO T 105	Standard Method of Test for Chemical Analysis of Hydraulic Cement
ASTM C 311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete

Noncompliant Material and Price Adjustment: The limits of available alkalies and calcium oxide do not apply to fly ash used as a mineral admixture.

Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with acceptable material. If product cannot be returned the following price adjustments are recommended:

Available Alkali Content (1.5% Maximum)

Available Alkali (1.5% Maximum)	Supplier	Aggregate Source	Price Adjustment
Greater than 1.5%	Approved	Non Reactive	25% of Fly Ash
Greater than 1.5%	Approved	Reactive	75% of Fly Ash
Greater than 1.5%	Non Approved	Non Reactive	25% of Contract Item
Greater than 1.5%	Non Approved	Reactive	25% of Contract Item

Calcium Oxide Content (maximum of 11%)

Calcium Oxide (11% Maximum)	Supplier	Aggregate Source	Price Adjustment
Greater than 12% but less than 13%	Approved	Non Reactive	25% of Fly Ash
Greater than 12% but less than 13%	Approved	Reactive	75% of Fly Ash
Greater than 12%	Non Approved	Non Reactive	25% of Contract Item
Greater than 12%	Non Approved	Reactive	25% of Contract Item
Greater than 13%	Approved	Non Reactive	25% of Contract Item
Greater than 13%	Approved	Reactive	25% of Contract Item

Loss On Ignition Content (1.5% Maximum)

Loss On Ignition (1.5% Maximum)	Supplier	Aggregate Source	Price Adjustment
Greater than 1.5%	Approved	Non Reactive	25% of Fly Ash
Greater than 1.5%	Approved	Reactive	75% of Fly Ash
Greater than 1.5%	Non Approved	Non Reactive	25% of Contract Item
Greater than 1.5%	Non Approved	Reactive	25% of Contract Item

340.05.09 Glass Beads.

Sample Frequency: According to the Idaho Quality Assurance Manual.

Specifications:

FSTM TT-B-1325D*	Federal Specification Beads, (Glass Spheres), Retro-Reflective
AASHTO M 247	Standard Specification for Glass Beads Used in Traffic Paints

Idaho Transportation Department Specifications for Dual Chemically Coated Glass Spheres (Beads) for Water Borne Traffic Line Paint

Test Methods:

ASTM D1155	Specification Test Method for Roundness of Glass Spheres
ASTM D1214	Specification Test Method for Sieve Analysis of Glass Spheres
FSTM TT-B-1325D*	Federal Specification Beads, (Glass Spheres), Retro-Reflective
Special IDAHO Test*	Adherence and Anti-Wetting Coating Tests

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with an acceptable product. Price adjustments are not in place for this material.

***See Chemistry Central Laboratory Personnel for current Method Procedures.**

340.05.10 Latex Modifier.

Sample Frequency: According to the Idaho Quality Assurance Manual.

Specifications:

Idaho Transportation Department Standard Specifications for Highway Construction

Test Method:

IDAHO T-121	Standard Method of Test for Determining Total Solids-Latex, Percent

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with an acceptable product. Price adjustments are not in place for this material.

340.05.11 Lime/Quicklime Products.

Sample Frequency: According to the Idaho Quality Assurance Manual.

Specifications:

ASTM C 977	Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization

Test Methods:

ASTM C 25	Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime
ASTM C 110	Standard Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with an acceptable product. Price adjustments are not in place for this material.

340.05.12 Structural Paint (All Formulas).

Sample Frequency: According to the Idaho Quality Assurance Manual or ITD contract.

- Formula No 1 – Primer, Inorganic Zinc Rich
- Formula No 2 – Primer, Organic Zinc Rich
- Formula No 3 – Primer, Zinc Rich Moisture-Cure Polyurethane
- Formula No 4 – Primer, High Solids Polyamide Epoxy
- Formula No 5 – Intermediate, High Solids Polyamide Epoxy
- Formula No 6 – Intermediate, Moisture-Cured Polyurethane, Micaceous Iron Oxide Reinforced, Performance Based
- Formula No 7 – Topcoat, High Solids Polyamide Epoxy
- Formula No 8 – Topcoat, High Solids Aliphatic Polyurethane
- Formula No 9 – Topcoat, Aliphatic Moisture-Cured Polyurethane
- Formula No 10 – Micaceous Iron Oxide – Aluminum, Moisture-Cured Polyurethane
- Formula No 11 – Primer, Latex, Exterior
- Formula No 12 – Primer, Latex, Exterior, Semi-Gloss
- Formula No 13 – Concrete Stain, Flat
- Formula No 14 – Highway Traffic Line Paint, Latex

Specifications:

ASTM D 520 (Type II)Standard Specification for Zinc Dust Pigment

SSPC Paint 20 Type I-C and Type II

SSPC Paint 27, 22, 36, 38, 40 & 41

TT-P-19	Federal Specification
TT-P-1984	Federal Specification

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

ASTM D 562	Standard Test Method for Consistency of Paints Measuring Kreb Unit (KU) Viscosity Using a Stormer-type Viscometer
ASTM D 823	Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels
ASTM D 968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1005	Standard Practices for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
ASTM D 1475	Standard Test Method for Density Liquid Coatings, Inks, and Related Products

ASTM D 2369	Standard Test Method for Volatile Content of Coatings
ASTM D 2486	Standard Test Methods for Scrub Resistance of Wall Paints
FTMS 4061.1	Standard Test Method for Drying Time of Coatings

Noncompliant Material and Price Adjustment: Material shall meet Idaho Transportation Department and Manufacturer's specifications. Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with an acceptable product. Price adjustments are not in place for this material.

340.05.13 Durable Markings (Epoxy, High Performance Tape, Methyl Methacrylate, Polyurea, Thermoplastic, etc.).

Sample Frequency: According to the Idaho Quality Assurance Manual or ITD contract.

Specifications:

AASHTO M 249	Standard Specification for White and Yellow Reflective Thermoplastic Striping Material (Solid Form)

Test Methods:

ASTM D 823	Standard Test Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels
ASTM D 4061	Standard Test Method for Retroreflectance of Horizontal Coatings

Noncompliant Material and Price Adjustment: Material shall meet Idaho Transportation Department and Manufacturer's specifications. Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with an acceptable product. Price adjustments are not in place for this material.

340.05.14 Waterborne Traffic Line Paint.

Sample Frequency: According to the Idaho Quality Assurance Manual or ITD contract.

Specifications:

Specifications for White and Yellow Waterborne Traffic Line Paint Idaho Transportation Department

Test Methods:

ASTM D 522	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
ASTM D 562	Standard Test Method for Consistency of Paints Measuring Kreb Unit (KU) Viscosity Using a Stormer-type Viscometer
ASTM D 661	Standard Test Method for Evaluating Degree of Cracking of Exterior Paints
ASTM D 711	Standard Test Method for No-Pick-Up Time of Traffic Paint
ASTM D 823	Standard Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels
ASTM D 869	Standard Test Method for Evaluating Degree of Settling of Paint
ASTM D 969	Standard Test Method for Laboratory Determination of Degree of Bleeding of Traffic Paint
ASTM D 1005	Standard Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
ASTM D 1394	Standard Test Methods for Chemical Analysis of White Titanium Pigments

ASTM D 1475	Standard Test Method for Density Liquid Coatings, Inks, and Related Products
ASTM D 2243	Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings
ASTM D 2369	Standard Test Method for Volatile Content of Coatings
ASTM D 2486	Standard Test Methods for Scrub Resistance of Wall Paints
ASTM D 2805	Standard Test Method for Hiding Power of Paints by Reflectometry
ASTM D 3723	Standard Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing
ASTM E 70	Standard Test Method for pH of Aqueous Solutions with the Glass Electrode
ASTM E 1347	Standard Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry Using Micrometers
FTMS 4051.1	Standard Test Method for Vehicle Solids
FTMS 6131	Standard Test Method for Yellowness Index

Noncompliant Material and Price Adjustment: Price adjustments will be assessed on product cost, excluding freight. Determination of the price adjustment to be applied will be based on ITD Materials Laboratory testing procedures. Total price adjustments will not exceed 50% or complete rejection. The price adjustments will be based on the paint price F.O.B.

- Density (lb/Gallon)

Density (plus or minus 0.20 lb/Gal)	Price Adjustment
Greater than 0.20 but less than or equal to 0.30 lb/Gal	25% of lot or batch number
Greater than 0.30 lb/Gal	50% or Rejection

- Viscosity (Krebs Units)

Viscosity (85 to 95)	Price Adjustment
83 K.U. to 97 K.U.	None
80 K.U. to 82 K.U. or 98 K.U. to 100 K.U.	25% of lot or batch number
Less than 80 K.U. or Greater than 101 K.U.	50% or Rejection

- Scrub Resistance (Cycles)

Scrub Resistance (800 cycles Minimum)	Price Adjustment
775 to 799	None
750 to 774	25% of lot or batch number
Less than 750	50% or Rejection

- pH (standard units)

pH (9.8 Minimum)	Price Adjustment
9.7 to 9.8	None
9.5 to 9.6	25% of lot or batch number
Less than 9.5	50% or Rejection

340.05.15 Silica Fume.

Sample Frequency: According to the Idaho Quality Assurance Manual or ITD contract.

Specifications:

AASHTO M 307	Standard Specification for use of Silica Fume as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout

Idaho Transportation Department Standard Specifications for Highway Construction

Test Methods:

AASHTO T 105	Standard Method of Test for Chemical Analysis of Hydraulic Cement
ASTM C 311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete
ASTM C 430	Standard Test Method for Fineness of Hydraulic Cement by the 45-um (No. 325) Sieve
ASTM C 1240	Standard Specification for Silica Fume Used in Cementitious Mixtures

Noncompliant Material and Price Adjustment**:** Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with an acceptable product. Price adjustments are not in place for this material.

Available Alkali Content (1.5% Maximum)

Available Alkali (1.5% Maximum)	Price Adjustment
Greater than 1.5%	25% of Silica Fume

Retained when wet-sieved on the #325 Screen (10% Maximum)

#325 Screen (10% Maximum)	Price Adjustment
Greater than 10%	25% of Silica Fume

340.05.16 Soils.

Sample Frequency: According to the Idaho Quality Assurance Manual.

Specifications: As determined by ITD

Test Methods:

USDA Soil Method*	Diagnosis and Improvement of Saline and Alkali Soils

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. The product is returned to the manufacturer and replaced with an acceptable product. Price adjustments are not in place for this material.

***See Chemistry Central Laboratory Personnel for current Method Procedures.**

340.05.17 Water for Concrete, Grout, and Mortar.

Sample Frequency: According to the Idaho Quality Assurance Manual.

Specifications:

Idaho Standard Specification for Highway Construction

Test Methods:

AASHTO T 26	Standard Method of Test for Quality of Water to be Used in Concrete
ASTM D 512	Standard Test Methods for Chloride Ion in Water
ASTM D 516	Standard Test Method for Sulfate Ion in Water
ASTM D 1125	Standard Test Methods for Electrical Conductivity and Resistivity of Water
ASTM D 1293	Standard Test Methods for pH of Water

Noncompliant Material and Price Adjustment: Noncompliant material is not accepted. Another source of water for concrete is located, sampled, and tested for compliance. Price adjustments are not in place for this material.

340.05.18 Hazardous Materials and Waste

Sample Frequency: As required.

Specifications: EPA Guidelines

Test Methods:

EPA Guidelines*	
USDA Soil Method 24*	Diagnosis and Improvement of Saline and Alkali Soils

Noncompliant Material and Price Adjustment: Not applicable.

***See Chemistry Central Laboratory Personnel for current Method Procedures.**

340.05.19 Used Lubricating and Hydraulic Oils.

Sample Frequency: According to ITD's Preventative Maintenance Program.

Specifications: According to ITD's Preventative Maintenance Program.

Test Methods:

ASTM D 445	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ASTM E 1252	Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis
ASTM D 4206	Standard Test Method for Sustained Burning of Liquid Mixtures Using the Small Scale Open-Cup Apparatus
ASTM D 6595	Standard Test Method for Determination of Wear Metals and Contaminants in Used Lubricating Oils or Used Hydraulic Fluids by Rotating Disc Electrode Atomic Emission Spectroscopy

Testing Tolerances: According to laboratory-determined acceptable ranges.

Noncompliant Material and Price Adjustment: Not applicable.

SECTION 350.00 ASPHALT LABORATORY

The Asphalt Laboratory is responsible for testing the quality of all bituminous products for highway construction projects and maintenance projects. The Asphalt Laboratory is AASHTO accredited and participates in American Materials Reference Laboratories (AMRL) proficiency testing.

350.01 Testing Procedures.

Specifications governing the quality of asphalt are found in the ITD Standard Specifications for Highway Construction, Subsection 702.

Asphalt samples received by the Asphalt Laboratory for testing fall within three general types:

1. Performance Graded Binders
2. Emulsified Asphalt
3. Special Products (Crack Filler, Bituminous Coatings, Anti-Strip Additive Approval, etc.)

350.01.01 Performance Graded Binders.

Testing of Performance Graded Binders consists of the following tests found in AASHTO Standards.

Flash C.O.C.	T 48
Brookfield Viscosity	T 316
Dynamic Shear (Original, RTFO, PAV)	T 315
Rolling Thin Film Oven Test	T 240
Pressure Aging Vessel	R 28
Bending Beam (Creep Stiffness, M-value)	T 313
Elastic Recovery	T 301
Anti-Strip Detection	Idaho IT-99

350.01.02 Anti-Strip Additives.

Field testing for the presence of anti-strip is performed in accordance with the ITD Quality Assurance Manual.

Anti-strip additives are accepted for use on ITD projects only when pre-approved by HQ Central Asphalt Laboratory and placed on the Qualified Products List (QPL). The products are tested by the ITD Central Asphalt Laboratory according to Idaho IT-137 and Idaho IT-99. The State reserves the right to conduct additional testing on materials if required to determine acceptance.

350.01.03 Emulsified Asphalt.

Emulsified asphalt is divided into three groups.

1. **Seal Coat Emulsions** (CRS-2, CRS-2R, CRS-P, etc.)

Seal Coat Emulsions are tested in conjunction with District Seal Coat Field Viscosity Testing (Idaho IT-61). All samples, whether field tested or not, are sent to the HQ Central Laboratory. If samples have been field tested, the Central Materials Laboratory will perform the following AASHTO tests.

Residue by Evaporation	T 59
Penetration on Residue	T 49
Elastic Recovery	T 301
Torsional Recovery (California Test Method)	CTM 332

NOTE: If viscosity has not been performed in the field, the HQ Central Laboratory will test for Viscosity (AASHTO T 59, or AASHTO T 72). All attempts will be made to perform viscosities within 30 days of the day of sampling. When the workload becomes heavy and there are two or more samples representing the same delivery ticket number, only one of these samples needs to be tested. If the sample passes, all samples representing the delivery ticket will be considered acceptable.

2. **Tack Coats and Fog Seals** (CSS-1, SS-1, etc.)

Tack Coat and Fog Seal Emulsion testing will include the following AASHTO tests.

Consistency Test (Saybolt Viscosity at 25°C or 77°F) T 59 and T 72

Residue by Evaporation	T 59
Penetration of Residue	T 49
Elastic Recovery	T 301
Torsional Recovery (California Test Method)	CTM 332

3. **Cold Mix Recycle Emulsions** (CMS-2, CMS-2s, etc.)

Cold Mix Recycle Emulsion testing will include the following AASHTO tests.

Consistency Test (Saybolt Viscosity at 50°C or 122°F)	T 59 and 72
Residue by Evaporation	T 59
Penetration of Residue	T 49

Elastic Recovery	T 301
Torsional Recovery (California Test Method)	CTM 332

The following procedure is used to perform the Evaporation Test:

The 50 gram samples of emulsion are cooked on a hot plate until all foaming is finished.

Follow with an oven treatment at 325°F for one hour.

350.02 Testing Tolerances and Price Adjustments.

The following sections give the values for testing tolerances and the price adjustment required if the asphalt samples are not within the tolerance range.

350.02.01 Performance Graded Binders.

Test Method	Deviation % of Spec Value	Price Adjustment
T-48 Flash Point C.O.C. (230°C minimum 450°F)	0 to 8.4	0%
	8.5 to 16.4	10%
	16.5 +	25%
T-316 Brookfield Viscosity (3 Pa·S. maximum)	0 to 10.4	0%
	10.5 to 20.4	10%
	20.5 +	25%
T-315 Dynamic Shear – Original (1.0 kPa minimum)	0 to 10.4	0%
	10.5 to 20.4	10%
	20.5 +	25%
Rolling Thin Film Residue (2.2 kPa minimum)	0 to 10.4	0%
	10.5 to 20.4	10%
	20.5 +	25%
T-315 Dynamic Shear – PAV Residue (5000 kPa maximum)	0 to 10.4	0%
	10.5 to 20.4	10%
	20.5 +	25%
T-240 Rolling Thin Film Oven Test (1.0% maximum loss)	0 to 20.4	0%
	20.5 to 40.4	10%
	40.5 +	25%
T-313 Bending Beam (Stiffness, 300 MPa maximum)	0 to 5.4	0%
	5.5 to 10.4	10%
	10.5 +	25%
T-313 Bending Beam (Slope, m-value .300 minimum)	0 to 5.4	0%
	5.5 to 10.4	10%
	10.5 +	25%
T-301 Elastic Recovery (50% minimum at 25°C)	0 to 5.4	0%
	5.5 +	25%

Noncompliant Material and Price Adjustment: Price adjustments will be assessed on product cost, excluding freight. Determination of the price adjustment to be applied will be based on ITD Materials Laboratory testing procedures. Total price adjustments will not exceed 50% or complete rejection. The price adjustments will be based on the binder price F.O.B.

Out-of-specification performance graded binder will be assessed a price adjustment based on the contractor's supplier price. The PG Binder will be clearly identified by "verification unit" and price reduction will be assessed on the entire lot.

350.02.02 Anti-Strip Additives.

Field testing for the presence of anti-strip is performed at the project site in accordance with the ITD Quality Assurance Manual. If plant mix is placed without anti-strip or with failing anti-strip results then the following price adjustment will apply.

Anti-Strip Test (BLUE ONLY)

Deviation	Price Adjustment on Mix Placed
Negative	25%

350.02.03 Emulsified Asphalt.

Test Method	Deviation % of Spec Value		Price Adjustment
	25°C (77°F)	50°C (122°F)	
Saybolt Viscosity (T-59)	0 to 15.4	0 to 21.4	0%
	15.5 to 30.4	21.5 to 42.4	15%
	30.5 +	42.5 +	25%
Residue by Evaporation (T-59)	0 to 1.4		0%
	1.5 to 2.4		15%
	2.5 +		25%
Penetration of Residue (T-49, D-5)	Below Minimum		
	0 to 16.4		0%
	16.5 to 24.4		15%
	24.5 +		25%
	Above Maximum		
	0 to 8.4		15%
	8.5 +		25%
Elastic Recovery (T-301)	Below Minimum		
	0 to 5.4		0%
	5.5 +		25%
Torsional Recovery (CTM 332)	Below Minimum		
	0 to 5.4		0%
	5.5 +		25%

When a failure occurs, any remaining samples representing that delivery ticket number must be tested. A price adjustment will be based on the contractor's supplier price.

350.03 Noncompliant Material and Price Adjustment Letters.

In the event of a failing asphalt test result, repeat the test. If the sample fails on retest, report the average of the two test results. Failing samples are retained in the laboratory for one year. If the sample passes specifications upon retest, report the sample as passing.

350.04 Asphalt Price Adjustment Letters.

When submitting a report that includes out-of-specification material, a Price Adjustment Letter will be sent to the District Engineer. The letter will include only one supplier's failures.

SECTION 360.00 STRUCTURES & CEMENT LABORATORY

360.01 The Structures Laboratory.

The Structures Laboratory tests the physical and mechanical properties of concrete, steel, and fasteners related to statewide construction. The testing may be performed in the laboratory or in the field, using destructive and/or nondestructive testing methods. All testing is accomplished in accordance with AASHTO and ASTM Test Methods and Specifications under the direction of the Quality Assurance Engineer. Sampling is performed at the project sites and submitted to the appropriate areas for testing. AASHTO and Cement & Concrete Reference Laboratories (CCRL) accreditation requirements are maintained.

360.02 Cement Laboratory.

The cement laboratory performs physical testing of cementitious materials. Cements, Types I, I and II, and III, are tested for specific properties designated by AASHTO and ASTM to ensure quality and consistency of the product. AASHTO and CCRL accreditation requirements are maintained. Samples are taken from the concrete supplier's storage, silos or bulker trucks. Cement samples brought into the laboratory are randomly sampled for chemical and physical analysis. All physical testing on cements is performed. Mortar pats, made for the ITD Chemistry Laboratory (see Section 340), are used for testing curing compounds.

360.03 Inspection of Pre-cast Concrete.

Personnel from the Structures Laboratory perform inspection of precast concrete components when required. Products inspected are numerous styles of girders, slabs, stiff legs, pipe, and wall panels, as well as decks and structures. This inspection is performed in-state and out-of-state for Idaho projects. Inspection is performed in accordance with project requirements, Standard Specifications for Highway Construction, and PCI (Precast Concrete Institute). The inspection may also be assigned to ITD District personnel or contracted to consultants or other state DOT personnel. Testing must be performed in accordance with AASHTO and ASTM requirements.

360.04 Verification of Portable Scales.

The Structures Laboratory performs load verification of portable scales for the Port-of-Entry (POE), County Sheriff, and Boise Police biannually. A universal test machine, which is certified by NIST standards annually, is used to verify the portable scales. Scale certification is performed in accordance with handbook 44 for Weight and Measurement Devices.

360.05 Steel Reinforcement Testing.

The Structures Laboratory is responsible to perform all acceptance or verification strength testing for steel reinforcement products, including metal rebar, steel strand, dowel bars, bolts, etc.

The test results are immediately emailed to the project staff and subsequently posted to the ITD intranet Central Laboratory page. A failing test will require an additional sample. Failing material is rejected and removed from the project.

360.06 Testing of Material.

Materials used in highway construction must comply with specified criteria as outlined in the ITD Standard Specifications for Highway Construction. The majority of the testing performed in the Structures Laboratory can be found in Standard Specification Subsections 409, 502, 506, and 703. The majority of the tests performed are AASHTO Test Methods; however, there are some ASTM and Idaho Test methods being utilized.

The following information is a complete listing of tests and specifications that are currently being used in the Structures Laboratory. Test methods and specifications are AASHTO unless otherwise noted.

360.06.01 Cement.

Test	Test Methods	Specifications
Sampling	T 127	M 85
Mechanical Mixing	T 162	T 162
Compressive Strength	T 106	M 85
Autoclave Expansion	T 107	M 85
Normal Consistency	T 129	M 85
Time of Set (Vicat)	T 131	M 85
Time of Set (Gilmore)	T 162 & T 154	M 85
Specific Gravity	T 133	M 85
Air Content	T 137	M 85
False Set (Paste Method)	T 162 & T 186	M 85
Flow Table & Caliper		M 152

360.06.02 Concrete Aggregate.

Test	Test Methods	Specifications
Sampling	T 2	409, 502 & 703 (Idaho)
Unit Weight	T 19	M 6
Organic Impurities	T 21	M 6
Sieve Analysis	T 27	M 6
Mortar Strength	IT-13	M 6
Specific Gravity, FA	T 84	
Specific Gravity, CA	T 85	
L.A. Wear, CA	T 96	M 80
Sand Equivalent	T 176	703 (Idaho)

360.06.03 Concrete.

Test	Test Methods	Specifications
Compressive Strength	T 22	409 & 502 (Idaho)
Obtaining & Testing Cores	T 24	409 & 502 (Idaho)
Slump	T 119	409 & 502 (Idaho)
Unit Weight, Fresh	T 121	From Mix Design
Laboratory Produced Concrete	T 126	409 & 502 (Idaho)
Sampling Fresh Concrete	T 141	409 & 502 (Idaho)
Air Content, Pressure Method	T 152	409 & 502 (Idaho)
Capping Concrete Cylinders	T 231	T 231
Mix Design, Absolute Volume	T 126	409 & 502 (Idaho)
Single Use Molds		M 205
Moist Cabinets & Curing Tanks		C 511 (ASTM)
Unit Weight, Hardened Concrete	IT 106	

360.06.04 Steel for Concrete Reinforcement.

Test	Test Methods	Specifications
Deformed Billet – Steel Bars	T 68 & T 244	M 31
Cold Drawn Steel Wire	T 68 & T 244	M 32
Welded Wire Fabric	T 68 & T 244	M 55
Uncoated Seven-Wire Strand	T 68 & T 244	M 203
Uncoated Stress Relieved Wire	T 68 & T 244	M 204
High Strength Alloy Bars	T 68 & T 244	M 215
Carbon Steel Bars, Plain Round	T 68 & T 244	M 227

360.06.05 Steel Plate Fasteners.

Test	Test Methods	Specifications
Hi-Strength Bolts	T 68 & T 244	M 164
Hi-Strength Nuts	RC Assembly	M 292
Hardened Washers	RC Assembly	M 293
DTIs (Direct Tension Indicators)	RC Assembly	F 959 (ASTM)
Brinell Hardness	T 70	
Rockwell Hardness	T 80	

360.06.06 Building Block Materials.

Test	Test Methods	Specifications
Blocks & Bricks	T 32	M 89 & M 114
Mortar & Grout Aggregate		C 144 & C 404 (ASTM)
Mortar	C 91 (ASTM)	C 270 (ASTM)
Flow or Grout	C 939 (ASTM)	Special Provisions

360.06.07 Joint Filler.

Test	Test Methods	Specifications
Sampling & Testing Joint Filler	T 42	M 153 & M 213

Section 400.00 - ITD Nuclear Gauge Program

SECTION 400.00 - ITD NUCLEAR GAUGE PROGRAM

The administration of the nuclear gauge program is handled through the HQ Central Laboratory. A person within the laboratory who is qualified as a Radiation Safety Officer (RSO) will manage this program statewide and provide liaison with the Nuclear Regulatory Commission (NRC). The RSO will ensure that all personnel will be trained in the safe handling and proper usage of nuclear equipment according to the policies and regulations set by the NRC. All personnel shall be provided with the proper equipment to perform their duties. Districts, operators, and equipment will be monitored on a routine basis for conformance to policies and regulations. Failure to comply could result in substantial penalties and fines to ITD as well as the individual.

SECTION 410.00 – ITD HQ Central Laboratory

The HQ Central Laboratory will carry the license, provide policies and regulations, and maintain a line of communication with the NRC.

The HQ Central Laboratory will provide, administer, and fund a program monitoring personal exposure to radiation, i.e., personal dosimetry, as well as provide, administer, and fund a leak testing program.

HQ Central Laboratory shall review nuclear gage operator certifications every quarter. Only qualified operators will receive TLDs (Thermo-Luminescent Dosimeters) for the quarter. This will ensure that TLDs are only distributed to operators who have current certifications. A notification will be sent to each District identifying those individuals who have expired certifications. Recertification classes will be offered as needed.

The HQ Central Laboratory will assign nuclear density gauges to districts and conduct a nuclear density gauge inventory every six months, or as requested, and provide a depot with storage for nuclear density gauges that require repair or recalibration.

The HQ Central Laboratory will maintain records on personnel, training, dosimetry, and nuclear density gauges. And will provide personnel exposure records to District RSOs and certification cards to qualified operators.

The ITD RSO will conduct an audit in each District at least once per year and record the findings of the audit to comply with NRC requirements.

The HQ Central Laboratory will oversee the procurement and funding of new nuclear density gauges, as well as disposal of old nuclear asphalt content or density gauges according to NRC regulations.

SECTION 420.00 – ITD District Materials Laboratories

Each ITD District Materials Engineer will assign at least one person to obtain required training and become qualified as the District RSO. The District RSO's duties include:

- Receive TLDs from HQ Central Laboratory for distribution to operators as necessary
- Collect TLDs each quarter and return them to the HQ Central Laboratory for evaluation
- Provide exposure records to gauge operators and distribute certification cards as required
- Maintain a permanent nuclear density gauge storage area
- Assign nuclear density gauges to residencies as needed
- Provide shipping papers and documents
- Ensure that nuclear devices are being used safely, transported correctly, and TLDs worn during gauge use
- Perform wipe tests on nuclear devices as requested
- Conduct an audit on randomly selected operators several times per year and provide results to the HQ Central Laboratory RSO

SECTION 430.00 – ITD District Residencies

Residencies will assign nuclear density gauges to qualified operators/projects with provisions for temporary storage sites, when necessary, and document the location. In addition, they will ensure proper use of nuclear devices and see that each user has a certification card, TLD, proper shipping papers, and a properly secured and labeled nuclear density gauge.

SECTION 440.00 – Required Training

HQ Central Laboratory provides all essential training to ITD District personnel within the program. Required classes include the following:

An 8-hour Nuclear Gauge Certification Class (NRC approved).

Gauge operator classes or on-the-job training.

Refresher classes every two years.

Persons at the District Level must attend the NRC approved 8-hour RSO class in order to qualify for the position of District RSO or Assistant District RSO.

Refresher classes may be instructed by state personnel familiar with the subject matter, such as the ITD RSO or a District RSO. Information presented must cover regulatory compliance, transportation, personal monitoring, emergency response, and general safety with radioactive materials.

The ITD RSO is required to attend a 40-hour training class conducted by the NRC.

SECTION 450.00 – Required Forms

The following list of forms will be used where required for compliance to the ITD Nuclear Gage Program:

- ITD-804 Certificate of Training for Transportation of Nuclear Devices
- ITD-817 Nuclear Program Audit
- ITD-823 Nuclear Gage Inventory Record
- ITD-824 Shippers' Certification for Radioactive Materials
- ITD-825 Nuclear Gage Inventory Record
- ITD-863 Nuclear Gage Dispatch Log
- ITD-864 TLD Personnel List – Nuclear Program
- ITD-866 Wipe Test Kit for Nuclear Density Gage (Internal & Rod Source)

SECTION 500.00 –STANDARD METHODS & PRACTICES

IDAHO STANDARD PRACTICE (IR), IDAHO STANDARD METHOD OF TEST (IT)

SECTION 510.00 - AGGREGATES

SECTION 520.00 - BITUMINOUS MATERIALS

SECTION 530.00 - CONCRETE

SECTION 540.00 - PAINT

SECTION 550.00 – SOILS

SECTION 560.00 - MISCELLANEOUS

* Appears in both Quality Assurance and Laboratory Operations Manuals.

Idaho Standard Method of Test for

Measuring Mortar-Making Properties of Fine Aggregate

Idaho IT-13-03

1. Scope

1.1 This method provides a means of determining whether a natural, unproven fine aggregate meets the minimum strength requirements for mortar making properties in concrete by comparing the compressive strength to the compressive strength of Ottawa Sand, the standard.

2. References

2.1. AASHTO: T-22, T-71, T-84 & M-152

2.2. ASTM: C-87, C-109, & C-778

3. Apparatus and Tools

3.1. Flow Table (drop table), flow mold, caliper, and 1” x 5/8” hard rubber tamper as described in AASHTO M-152

3.2. Cylinder molds, 2”x4”, either plastic single use, or brass, (waxed to a glass plate).

3.3. Mixing bowl and spoon. Small trowel and scoop.

3.4. Tamping rod, (3/8” diameter x 8”) with spherically rounded ends.

3.5. Balance, capable of reading to the nearest gram.

3.6. Capping compound and fixture for 2” diameter specimens.

3.7. Compression testing machine with proper sized spherical test head.

3.8. Moist Closet and lime saturated water bath

4. Temperature and Humidity

4.1. The temperature of the mixing water, the Moist Closet, and the storage tank water shall be maintained at 73.4 ±3 Degrees F (23.0 ±1.7 Degrees C).

4.2. The relative humidity of the Moist Closet shall not fall below 95%

4.3. During mixing and molding of test specimens, the laboratory shall be maintained at 50% or greater relative humidity

5. Sample Preparation

5.1. Natural Sand Mortar - (AASHTO T-84) this mortar shall be made using a representative sample of natural sand from the unproven source (3,000 to 5,000 grams).

5.1.1. The sand is moistened to a point past SSD, then covered and kept moist for a minimum of 15 hours to allow the sand to reach total saturation.

5.1.2. Dry the sand to an SSD condition per AASHTO T-84, being careful not to segregate material while constantly mixing.

5.1.3. Weigh 2500.0 grams, being careful to get a representative sample. Cover this sample to keep it in an SSD condition until needed.

5.1.4. Cement: Weigh 700.0 grams of Portland cement, either Type I & II or Type III.

5.1.5. Water: Measure 420.0 ml of conditioned water. Note: Conditioned water is distilled water at 73.4 ±3 Degrees F (23.0 ±1.7 Degrees C).

5.2. Ottawa sand mortar – This mortar is the standard of comparison.

5.2.1. Blend natural Ottawa sands, combined weight 2,500.0 grams. Combine 1,225.0 grams of graded sand, and 1,275.0 grams of 20-30 sand, both conforming to ASTM C-778, and thoroughly blend.

5.2.2. Cement: Weigh 700.0 grams of Portland cement, either Type I & II or Type III.

5.2.3. Water: Measure 420.0 ml of conditioned water.

Note: All tests shall be run using the same cement Type, Manufacturer, and Lot. The amounts of water and cement used in this method are never varied. All of the water and cement must be used to maintain a consistent W/C ratio (0.60) between all samples. The amount of sand added to the mixture is varied to get the proper flow.

5.3. If brass molds are to be used, apply a light coating of release agent or light oil to molds. This will allow for removal of specimens without damage.

5.4. Start with a *damp bowl* and add 420.0 ml of conditioned water

5.5. Add 700.0 grams of cement and let it absorb for 1 minute

5.6. Stir by hand into a smooth paste.

5.7. Add the sand while stirring continuously until the desired consistency of the mix has been reached. Note: Normally, the mix will achieve the required consistency before all of the sand (2,500 grams) is used.

5.8. Stir the mixture vigorously for 30 seconds, then perform a flow test

6. Flow Test

6.1. Fill the cone in two layers, 20 blows per layer with the hard rubber tamping tool. The mixture should overfill the cone at this point

6.2. Cut the excess mortar off using the edge of a trowel creating a plane surface.

6.3. Carefully lift the cone off the mixture leaving the molded specimen on the table. The entire process to this point should be performed in one minute.

6.4. At exactly one minute, start flow table and drop 10 times. The mortar shall be proportioned to produce a consistency of 95-105 in 10 drops of the flow table.

Note: Allowance for flow trial – One free trial may be performed, but only if mix is too wet and the only ingredient that may be added is sand, to stiffen the mix. Then remix (.5.7), and perform flow again starting with (6.1).

6.5. After flow measurement, immediately place the mortar back in the bowl and remix vigorously for 15 seconds.

6.6. Fill cylinder molds (brass or plastic) in three layers, each layer receiving 25 blows using the tamping rod with spherical end. Make two sets of 3 cylinders, (6 total). One set for 3 days & one set for 7 days if Type III cement is used, or one set for 7 days and one set for 28 days if Type I & II cement is used.

6.7. Cut off the mortar to a plane surface, flush with the top of the mold, by drawing the straight edge of a trowel with a sawing motion across the top of the mold.

6.8. Place the cylinders in the Moist Closet for curing.

7. Curing Specimens

7.1. After 20 to 24 hours of curing in the Moist Closet, the specimens shall be removed from the molds, marked for identification, and immediately placed in a temperature controlled, lime saturated water bath for final curing.

7.2. 7.2. Cylinders shall remain in the water bath to cure for a period of 3 days & 7 days, or 7 days & 28 days, depending on the cement type used. They will be removed from the water bath in sufficient time to perform the capping procedure and allow for curing of capping compound prior to testing. Testing shall be performed within ±1 hour for 3 day tests, ±2 hours for 7 day tests, & ±20 hours for 28 day tests, from the time of molding.

8. Capping Specimens

8.1. Cylinders shall be capped before testing in such a manner that the ends will be plane and at right angles to the axis of the cylinder. While cylinders are in the capping process, they shall be maintained in a moistened condition by covering with wet towels. Any conventional capping material may be used.

9. Testing Specimens

9.1. Cylinders shall be tested for compressive strength at 3 days and 7 days, or 7 days and 28 days after molding. Testing age of cylinders depends on cement Type used to make test specimens.

9.2. If more than one specimen is removed from the storage water for testing, these specimens shall be covered with a wet towel to keep specimens in a moistened condition until time of testing.

9.3. Before placing the test cylinders in the compression test machine, they shall be wiped to a surface dry condition and have any loose sand and/or debris removed from the bearing test surfaces.

9.4. Place the cylinder carefully in the test machine centering it on the upper bearing block. Check the spherical head (upper) for freedom of movement prior to the beginning of each test. A constant load shall be applied without interruption until failure, at a rate of 20 psi to 50 psi per second, (standard loading rate for cylindrical specimens, AASHTO T-22). No adjustment shall be made in the controls of the testing machine while a specimen is yielding rapidly just prior to failure.

10. Acceptance

10.1. Acceptance is based on a comparative strength between the two mortars. The natural sand mortar must be at least 90% of the strength that is achieved by the standard sand mortar.

Idaho Standard Method of Test for

Idaho Degradation

Idaho IT-15-95

1 Scope

1.1 This test method is intended as a quantitative measure of the resistance of a graded aggregate to production of fines by abrasion in the presence of water. The test provides a means by which it is possible to evaluate how the aggregate may perform in the road.

2 Apparatus

2.1 Idaho Degradation Machine. The Idaho Degradation Machine is equipped with an electric motor with gear reduction. The machine shall maintain a substantially uniform speed of 30 to 33 rpm. Metal cans equipped with spring tension handles to securely hold 3.8 liter jars in place are so positioned that the jars rotate end over end. Diameter of the metal cans shall be such that the jars are a snug fit, but can be inserted and removed without binding. The cans shall be deep enough so that the straight portion of the jar sidewall is completely within the can.

2.2 Wide mouth 3.8 liter jars with lids. The lids are fitted with solid 3 mm thick rubber gaskets.

2.3 Sieves. A set of U.S. Standard, 203 mm diameter sieves 19 mm through 75 μm. These sieves shall meet AASHTO M 92 specifications.

2.4 Sand Equivalent apparatus as described in AASHTO T 176.

2.5 Scoop, brush and rustproof drying container approximately 460 mm x 300 mm x 50 mm deep.

2.6 Drying Oven - 60°C maximum.

2.7 Balance with a 2000 g capacity sensitive to 0.1 g.

3 Preparation of Sample

3.1 Sample make-up (oven dry at 60°C max.).

3.1.1 The sample for testing with 12.5 mm or larger size aggregate shall have the following gradation:

16.7% Passing the 19 mm and Retained on the 12.5 mm		183 g.
16.6% Passing the 12.5 mm and Retained on the 9.5 mm		183 g.
16.7% Passing the 9.5 mm and Retained on the 4.75 mm		184 g.
50% Passing the 4.75 mm		550 g.
	Total	1100 g.

3.1.2 The sample for testing with 9.5 mm size aggregate shall have the following gradation:

25% Passing the 12.5 mm and Retained on the 9.5 mm	275 g.
25% Passing the 9.5 mm and Retained on the 4.75 mm	275 g.
50% Passing the 4.75 mm	550 g.
Total	1100 g.

3.1.3 The sample for testing with 4.75 mm size aggregate shall have the following gradation:

50% Passing the 9.5 mm and Retained on the 4.75 mm	550 g.
50% Passing the 4.75 mm	550 g.
Total	1100 g.

3.2 Combine oven dried original and crushed portions representative of the gradation of the material as intended for use. For material coarser than the 4.75 mm sieve, thoroughly mix original and crushed portions and weigh out exactly the specified amount. Obtain the specified amount of 4.75 mm material by the method of quartering or by the use of a sample splitter as described in AASHTO T 248.

Note 1: The coarse portion of the sample shall be hand shaken to refusal on each specified sieve size before make-up. Hand shaking shall continue until not more than 1% by weight of the residue passes any sieve during one (1) minute.

4 Procedure

4.1 Place the prepared oven dried material (maximum drying temperature 60^{o}C) in a wide mouth 3.8 liter jar and enough water to cover the aggregate to a depth of approximately 13 mm.

4.2 Allow the sample to soak at least 16 hours.

4.3 If necessary, after the soaking period adjust the water in the jar so the aggregate is barely covered.

4.4 Place lid with rubber gasket on jar and seal tightly. Fit the jar into the Idaho Deg. Machine making certain that the spring tension handle is securely holding the jar.

4.5 Start the Idaho Deg. Machine and allow the jar to make 1,850 revolutions. The tumbling action of the aggregate as the jar rotates end over end produces the degradation.

4.6 At the end of the test period empty the contents of the jar over a 4.75 mm sieve placed over a container to catch all the 4.75 mm material and water.

4.7 Wash out the jar using as little water as possible. Wash the plus 4.75 mm material until all the fines sticking to the aggregate are washed into the minus 4.75 mm portion of the sample. Place the container with the minus 4.75 mm portion in the oven for drying.

4.8 Oven dry the plus 4.75 mm material and then shake to refusal over the appropriate coarse sieves. If any material passes the 4.75 mm sieve, it is to be added to the minus 4.75 mm portion.

4.9 Stir the minus 4.75 mm portion occasionally and remove from oven when a cast point is reached. A cast point is defined as that point when a portion tightly squeezed in the palm of the hand will form a cast which will bear very careful handling without breaking.

4.10 When the cast point is reached, run sand equivalent on the minus 4.75 mm material according to AASHTO T 176.

4.11 Retain the material from the sand equivalent test and return it to the minus 4.75 mm portion.

4.12 Wash entire minus 4.75 mm portion over 75 µm sieve, dry and sieve as described in AASHTO T 11.

4.13 Compute the total gradation based on initial oven dry weight of 1100 g. This becomes the gradation after degradation.

Note 2: Weights should be recorded to the nearest gram.

5 Report

5.1 The before-test gradation and sand equivalent together with the after-test gradation and sand equivalent are reported. The amount of degradation is indicated by the difference in test values.

Note 3: If the before-test gradation of material passing the 4.75 mm sieve is measured by sieve analysis of a representative sample for which the % Passing 4.75 mm is 50%, then the before-test percentages for 4.75 mm and finer sieves from the analysis are equal to the sieve analysis percentage. Otherwise, all before-test percentages for 4.75 mm and finer sieves must be multiplied by the adjustment factor. The adjustment factor is 50 divided by the percentage of material passing 4.75 mm in the representative before-test gradation sample. For example, if the 4.75 mm and finer before-test percentages are determined on sample consisting of 100% minus 4.75 mm material, the adjustment factor is 50/100=0.50. Similarly, if the sample for determining before-test gradation has 40% minus 4.75 mm, the adjustment factor for 4.75 mm and finer sieves is 50/40=1.25.

5.2 The test results shall be reported on an ITD-802.

6 Precautions

6.1 Avoid baking sample during drying period prior to sand equivalent test.

6.2 Be sure to return all of the material from the sand equivalent test back into the minus 4.75 mm portion.

Idaho Standard Method of Test for

Evaluating Cleanness of Cover Coat Material

Idaho IT-72-08

1 Scope

1.1 The cleanness test indicates the relative amount, fineness and character of clay-like materials present in aggregate as coatings or otherwise.

2 References

2.1 AASHTO Standards

- M 92– Wire Cloth Sieves for Testing Purposes.
- M 231– Weighing Devices Used in the Testing of Materials.
- T 176– Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.
- T 248– Reducing Field Samples of Aggregates to Testing Size.

2.2 California Test 227 – Method of Test for Evaluating Cleanness of Coarse Aggregate.

3 Apparatus

3.1 Balance – Capacity sufficient for the sample mass, accurate to 0.1 percent of the sample mass or readable to 0.1g. Meets the requirements of AASHTO M 231.

3.2 Sample Splitter – Meets the requirements of AASHTO T 248.

3.3 Graduate assembly – Consists of:

3.3.1 funnel large enough to hold 8 inch brass wire sieves at the large end and necked down to approximately 2 in. diameter at the other end,

3.3.2 No. 8 (2.36mm) & No. 200 (0.75mm) 8 inch brass wire sieves, Meeting the requirements of AASHTO M 92.

3.3.3 500 ml graduate cylinder.

3.4 Washing vessel (as described in Figure 1) or wide-mouth 3.8 L jar with lid and rubber gasket.

3.5 Mechanical shaker – Uses oscillation or orbital action capable of securely holding the washing vessel.

3.6 Sand equivalent (SE) cylinder – Conforming to AASHTO T 176 with rubber stopper.

3.7 Graduate cylinders – 10 ml and 500 ml.

3.8 Sand equivalent (SE) solution (Stock) Conforming to AASHTO T 176

3.9 Syringe or spray attachment.

3.10 Potable water, i.e., tap water or bottled water at approximately the same temperature as the stock solution, but not at a higher temperature than the maximum temperature allowed by AASHTO T176.

4 Sample Preparation

4.1 Obtain a sample of cover coat material (CCM) in accordance with the FOP for AASHTO T 2 and reduce to 1000 ±50 grams in accordance with the FOP for AASHTO T 248.

Note 2: Sample shall be placed in a sealed container, such as concrete cylinder mold, to prevent loss of moisture. Sample shall be run in condition of placement on roadway i.e. moist. Sample shall not be allowed to dry.

4.2 Using a 10 ml graduate cylinder obtain 7 ml of SE solution.

4.3 Pour the 7 ml of SE solution into the SE cylinder.

4.4 Assemble the graduate assembly (#8 (2.36mm) sieve, #200 (0.75mm) sieve, funnel, 500 ml graduate cylinder).

5 Procedure

5.1 Place the 1000 ±50 gram CCM sample in the washing vessel or wide-mouth jar. Spread the material evenly across the bottom of the vessel or jar. Add only enough water to cover the aggregate.

5.2 Allow the sample to soak for one (1) minute from the introduction of wash water into the vessel or jar.

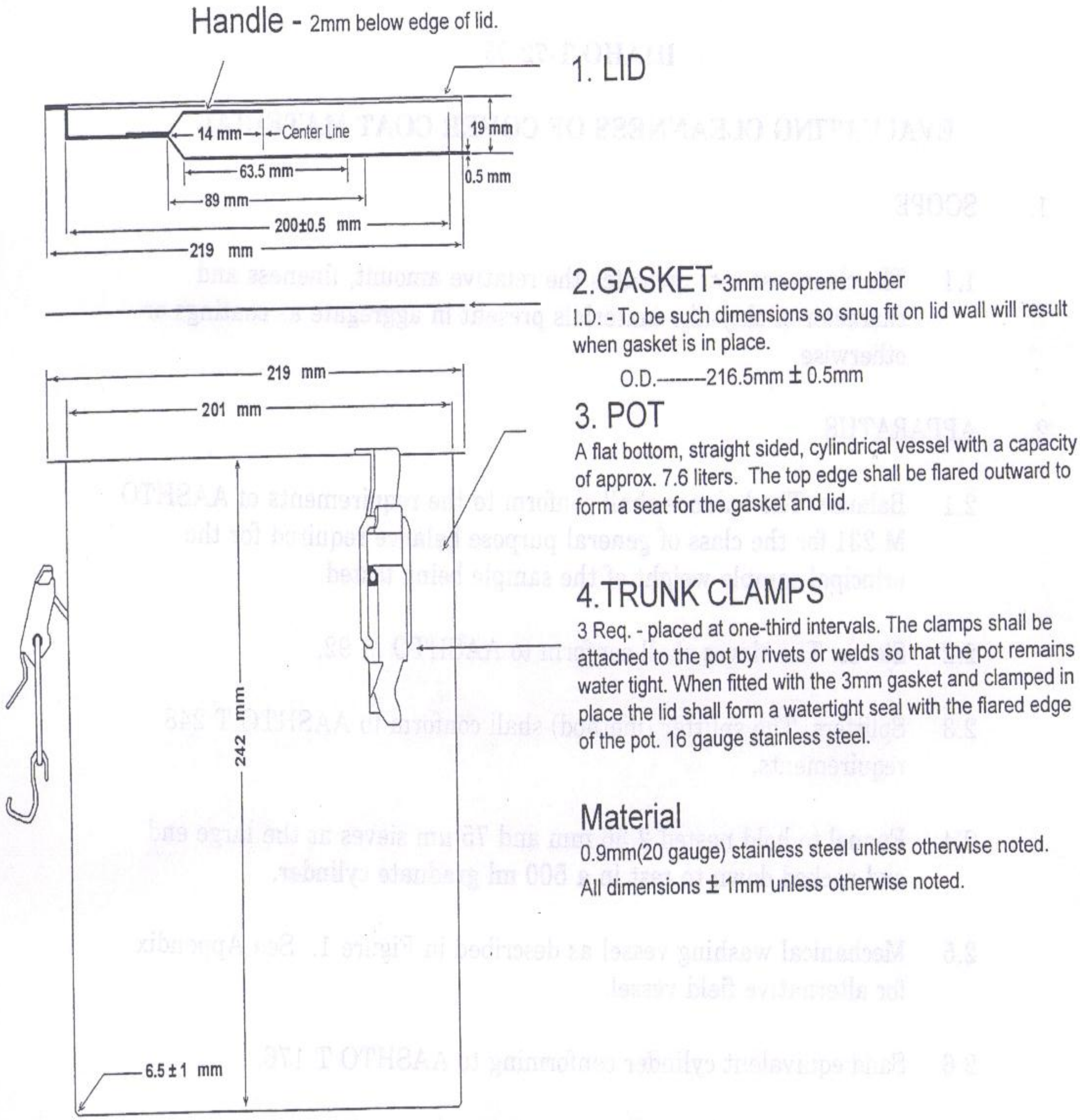
5.3 Agitate the sample by either mechanical or hand method

5.4 Mechanical Method

5.4.1 Seal and secure the wash vessel in the mechanical shaker.

5.4.2 Agitate the vessel for two (2) minutes, without using the hammer if the shaker has one.

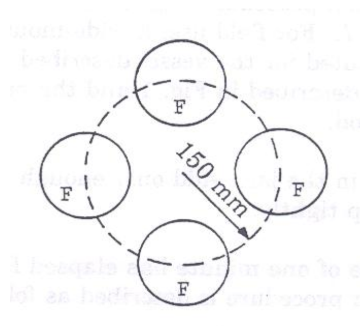
Figure 1—Washing
Vessel



5.5 Hand Method

5.5.1 Seal the jar with lid and rubber gasket.

5.5.2 Hold the jar vertical with both hands either by the sides or by the top and bottom. Agitate the sample in the vessel, creating an arm motion that causes the jar to describe a circle with at least a 6 in. (150 mm) radius. See the sketch showing the path of the jar during the agitation period. Use of a countertop with a 6 in (150 mm) radius drawn on the surface will help in this operation.



Note: The jar itself does not turn on its vertical axis. The jar's vertical axis describes a circle with a 6 in. (150 mm). radius as near as possible. Note # 3: side F always faces the operator.

5.5.3 Continue this agitation at the rate of three (3) complete rotations per second for one (1) minute.

6 Measure for Cleanness

6.1 Remove the lid from the vessel or jar. Continue agitating the vessel by hand to keep the fine contents in suspension. Pour all contents over the graduate assembly.

6.2 Wash out the vessel or jar over the graduate assembly using the syringe or spray attachment until the graduate cylinder is filled to 500 ml. mark.

6.3 Remove the sieves and funnel portion for the graduate assembly from the 500 ml graduate cylinder. Bring the solids into suspension by capping the cylinder with the palm of the hand and turning the cylinder upside down then right side up, ten (10) times, through an 180^{o} arc as rapidly as possible.

6.4 Immediately pour the thoroughly mixed liquid into the SE cylinder until the 15 inch mark is reached. Cap the SE cylinder with a rubber stopper.

6.5 Mix the contents of the SE cylinder by alternately turning the cylinder upside down and right side up, allowing the air bubble to completely traverse the length of the cylinder. Repeat this cycle 10 times. A cycle is from right side up to upside down to right side up.

6.6 On a worktable that is not subject to vibrations allow the SE cylinder and contents to stand undisturbed for 20 minutes ± 15 seconds.

6.7 After 20 minutes, read and record to the nearest 0.1 inch the height of the column of sediment.

7 Calculations

7.1 Compute the cleanness value to the nearest whole number.

$$CV = \frac{3.214 - (0.214 \times H)}{3.214 + (0.786 \times H)} \times 100$$

Where:

CV = Cleanness Value

H = Height of Sediment in inches

QUALIFICATION CHECKLIST

CLEANNESS VALUE – IDAHO T 72

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element		Trial 1	Trial 2
General			
1. The sample was maintained moist in sealed container.	1	____	____
2. The sample is equal to 1000 ± 50 grams.	2	____	____
3. There is 7 ml of SE solution in SE tube.3	3	____	____
4. The graduate assembly including sieves, funnel and 500 ml graduate cylinder is properly put together.	4	____	____
5. CCM sample was placed in washing vessel or jar and water was added just covering the aggregate.	5	____	____
Mechanical Method			
6. The vessel was secure in the shaker.	6	____	____
7. Agitation was started after one (1) minute.	7	____	____
8. The vessel was agitated for two minutes.	8	____	____
Hand Method			
9. Agitation was started after one (1) minute.	9	____	____
10. The vessel was properly rotated with 150mm radius.	10	____	____
11. Vessel was agitated 3 complete rotations per second.	11	____	____
12. Vessel was agitated for one (1) full minute.	12	____	____
Measure for Cleanness			
13. All contents of vessel or jar were washed over sieves into the 500 ml graduate cylinder.	13	____	____
14. Cylinder was rapidly turned upside down at 180º, ten (10) times.	14	____	____
15. Mixture was poured into SE cylinder to 15 inch mark.	15	____	____
16. SE Cylinder was rotated at least ten (10) complete cycles. Bubble traveled full length of tube.	16	____	____
17. Cylinder was allowed to stand 20 minutes on work table free from vibrations.	17	____	____
18. The sediment reading was to the nearest 0.1 inch.	18	____	____
19. Calculations were accurate to the nearest whole number.	19	____	____

Comments: First Attempt: Pass ☐ Fail ☐ Second Attempt: Pass ☐ Fail ☐

Testing Technician's Name: ______________________________WAQTC # : _________Date: _________

Examiner's Name: _______________________________ Signature _______________________________

Idaho Standard Method of Test for

Vibratory Spring-Load Compaction for Coarse Granular Material

Idaho IT-74-98

Idaho IT-74 is identical to WSDOT Test Method No. 606, "Method of Test for Compaction Control of Granular Materials," with the following exceptions.

A. Delete 1.1b and replace as follows: When Idaho IT-74 is specified as an alternative to AASHTO T 99 or AASHTO T 180, Idaho IT-74 should be used if the material has more than about 10% retained on the 3/4 in. (19 mm) screen.

B. Use of the WSDOT forms included in Test Method No. 606 is optional. ITD forms may be substituted.

WSDOT Test Method T 606
Method of Test for Compaction Control of Granular Materials

1. Scope

a. This test method is used to establish the theoretical maximum density of granular materials and non-granular materials with more than 30% by weight of the original specimen is retained on the No. 4 Sieve or more than 30% by weight of the original specimen is retained on the ¾" sieve.

b. There are three separate tests in this method which present a method for establishing the proper theoretical maximum density values to be used for controlling the compaction of granular materials. These tests account for variations of the maximum obtainable density of a given material for a given compactive effort, due to fluctuations in gradation.

c. By splitting the material on the U.S. No. 4 (4.75 mm) sieve and determining the specific gravity, the compacted density, and the loose density of each of the two fractions, a curve of theoretical maximum density versus percent passing the U.S. No. 4 (4.75 mm) sieve can be plotted. These curve values will correlate closely with the densities obtained in the field; using modern compaction equipment.

d. Table 1 identifies the Test, Method or Procedure to use in performing T 606. The table is divided into the Fraction of the split (Fine or Coarse) and the material type of that Fraction.

Test Method Selection Table	
Fine Material	
Soil Type	**Test Method**
Sandy, Non Plastic, Permeable	T606 Test 1
Silt, Some Plasticity, Low Permeability	T 99 Method A
Sandy Silt, Some Plasticity, Permeable	T 606 Test 1 / T 99 Method A (use higher results)
Coarse Material	
No more than 15% by weight of original aggregate specimen exceeds ¾" (19 mm)	T 606 Test 2 Procedure 1
15% or more by weight of original aggregate specimen is greater than ¾" (19 mm), but does not exceed 3 in. (76 mm)	T 606 Test 2 Procedure 2

Table 1

e. The test methods are applicable either to specifications requiring compacting to a given percentage of theoretical maximum density, or to specifications requiring compaction to a given compaction ratio.

f. Use of these test methods eliminates the danger of applying the wrong "Standard" to compaction control of gravelly soils.

g. Native soils within the contract limits to be used for embankment construction and/ or backfill material do not require the sampling by a qualified tester. For material that requires gradation testing such as but not limited to manufactured aggregates and Gravel Borrow, a qualified tester shall be required for sampling.

Test No. 1
(Fine Fraction-l00 Percent Passing U.S. No. 4 (4.75 mm) Sieve)

1.1 Scope

a. This test was developed for the sandy, non-plastic, highly permeable soils which normally occur as the fine fraction of granular base course and surfacing materials.

b. When the fine fraction is primarily a soil having some plasticity and low permeability, AASHTO T 99 (Standard Proctor Test) may be used. With borderline soils, both tests should be applied and the one yielding the highest density value should be used.

1.2 Apparatus

a. Vibratory, Spring Load Compactor — Specifications for vibratory spring load compactor can be obtained from the State Materials Lab.

b. Mold — Molds can be fabricated from standard cold drawn-seamless piles or tubes. The dimensions for the small mold are; height 8 in (± 0.002 in), ID 6 in (± 0.002 in). The wall thickness of the mold shall be no less than ¼ in. The mold has a bottom plate which attaches to the mold and is slightly larger than the outer diameter of the mold. The small button at the center of the small mold follower is a measuring point. The height of this button should be adjusted so the machine follower does not bear on it during compaction.

c. Mold Piston — A piston which has a bottom face diameter of 5 ⅞ in (150 mm) OD and an overall height of 2 in. The top of the piston shall have a 2 ¼ in ID.

d. Height-Measuring Device — A scale with an accuracy of 0.01 in (0.25 mm).

e. Tamping Hammer — As specified in AASHTO T 99, Section 2.21.

f. Sieve — U.S. No. 4 (4.75 mm) sieve.

g. Oven — Capable of maintaining a temperature of 230° ± 5°F (110 ± 5° C) for drying moisture specimens.

h. Balance — A balance having a capacity of 100 lbs (45 kg) and a minimum accuracy of 0.1 lbs (50 g).

i. Tamping Rod — ⅝ in (16 mm) spherical end.

1.3 Procedure

a. Oven-dry the total original sample at a temperature not to exceed 140°F (60°C).

b. Obtain tare weight of mold and bottom plate, record weight (mass) to the nearest 0.01 lb (5 g) or less if using a balance that is more accurate than 0.1 lbs.

c. Sieve the entire specimen over a No. 4 (4.75 mm) sieve to separate the fine and coarse material. Retain the coarse material for the second half of the procedure (T 606 Test 2).

d. Split the No. 4 minus material in accordance with WSDOT FOP for AASHTO T 248 to obtain a representative specimen of approximately 13 lbs (6 kg). (This mass can be adjusted after the first compaction run to yield a final compacted specimen approximately 6 in (150 mm) high.)

e. Estimate the optimum moisture for the material. Calculate the mass of water required for optimum moisture and add water to specimen.

Weight of Water

Equation: *Wt. of water = (decimal percent water)(mass dry sample)*

f. Mix the specimen until the water and dry material are thoroughly and completely mixed.

g. Place the specimen in the mold in three layers. Rod each layer 25 times and tamp with 25 blows of the tamping hammer. The blows of the hammer should produce a 12 in (305 mm) free fall provided severe displacement of the specimen does not occur. In such cases, adjust the blow strength to produce maximum compaction. The surface of the top layer should be finished as level as possible.

h. Place the piston on top of the specimen in the mold, and mount the mold on the jack in the compactor. Elevate mold with the jack until the load-spring retainer seats on top of the piston. Apply initial seating load of about 100 lbs (45 kg) on the specimen.

i. Start the compactor hammers and, at the same time, gradually increase the spring load on the specimen to 2,000 lbs (908 kg) by elevating the jack in accordance with Table 2.

j. Check the mold for specimen saturation. The specimen is considered saturated when, free water (a drop or two of water) shows at the base of the mold. If water is not present at the base of the mold within the first 1½ minutes stop the test, remove the specimen from the mold and repeat 1.3 e-j. The specimen can be reused for subsequent water contents providing it is not a fragile material.

k. Caution: Most materials will yield the highest density at the moisture content described above. Some materials may continue to gain density on increasing the moisture above that specified; however, severe washing-out of the fines will occur, which will alter the character of the sample and void the test results.

l. If moisture is observed at the base of the mold continue applying loads at the following rates:

Load in lbs (kg)	Time in Minutes
100 to 500 lbs (45 to 227)	1
500 lbs to 1,000 lbs (227 to 454)	1/2
1,000 lbs to 2,000 lbs (454 to 908)	1/2

Rate of Load Application
Table 2

m. After reaching 2,000 lbs (908 kg), stop the hammers, release the jack, and return to zero pressure.

n. Repeat step h. four additional times; remove the mold from the compactor.

o. Measure and record the height of the compacted specimen to the nearest 0.01 in (.25 mm) and calculate the volume (see Section 1.4)

p. Remove the specimen from the mold, weigh it, and record its mass (weight) to the nearest 0.01 lbs (5 g), and calculate the wet density.

q. Vertically slice through the center of the specimen, take a representative specimen (at least 1.1 lbs (500 g)) of the materials from one of the cut faces (using the entire specimen is acceptable), weigh immediately, and dry in accordance with AASHTO T 255 to determine the moisture content, and record the results. Calculate and record the dry density.

r. Repeat steps d. through m. at higher or lower moisture contents, on fresh specimen if needed, to obtain the theoretical maximum density value for the material, three tests are usually sufficient.

1.4 Calculations

a. The formula for calculating the volume and dry and wet densities are as follows:

$$V = \frac{(H1-H2)(B)}{1728}$$

Where:

V= Volume, ft^3

H_1= Inside height of the mold, in
H_2= Height from top of the specimen to the top of the mold, in
B = Inside bottom area of the mold, in^2

$$\text{Wet Density (pcf)} = \frac{Wet\ Mass\ (Weight, lbs.)}{Volume\ (cu.ft.)}$$

$$\text{Dry Density (pcf)} = \frac{Wet\ Density\ (pcf)}{1 + Moisture\ Content\ (in\ decimal)*}$$

*Note: See AASHTO T 255-00"Total Moisture Content of Aggregate by Drying," for moisture content calculations.

Test No. 2
(Coarse Fraction-100 Percent Retained on the U.S. No. 4 (4.75 mm) Sieve)

2.1 Scope

a. This test is used when there is 100 percent retained on the U.S. No. 4 (4.75 mm) sieve. There are two separate procedures based on the maximum size of the aggregate being tested. Procedure 1 is used when no more than 15% by weight of the original specimen of the coarse aggregate exceeds ¾ in (19 mm). Procedure 2 is used when 15% or more by weight of the original specimen of the aggregate is greater than ¾ in (19 mm), but does not exceed 3 in (76 mm). If there is any aggregate greater than 3 in (76 mm), it has to be removed before proceeding with the test.

Procedure 1
(Aggregate Size: No. 4 to ¾ in (19 mm)

2.2 Equipment

a. The apparatus for this test is the same as that used in Test No. 1

2.3 Procedure

a. From the coarse split obtained in Test No. 1, Section 1.3(C), separate a representative specimen of 10 to 11 lbs (4.5 to 5 kg) and weigh to 0.01 lbs (5 g), or less if using a balance that is more accurate than 0.1 lbs.

b. Dampen the specimen to 2½% moisture and place it in a 0.1 ft^3 (0.0028 m^3) mold, in three lifts. Tamp each lift lightly to consolidate the material to achieve a level surface. Omit rodding. Avoid loss of the material during placement.

c. Place the piston on top of the specimen in the mold, and mount the mold on the jack in the compactor. Elevate mold with the jack until the load-spring retainer seats on top of the piston. Apply initial seating load of about 100 lbs (45 kg) on the sample.

d. Start the compactor hammers and, at the same time, gradually increase the spring load on the sample to 2,000 lbs (908 kg) by elevating the jack in accordance with the Table 2.

e. Follow procedure described in Test No. 1 Section 1.3 m through 1.3 r.

f. Using the original dry weight value, calculate the dry density in lb/ft^3 (kg/m^3). Use the formula for dry density described in Test No.1, Section 1.4.

Procedure 2
(Aggregate Size: No. 4 to 3 in (76 mm))

2.4 Equipment

a. ½ ft^3 (0.014 m^3) standard aggregate measure.

b. A metal piston having a diameter ⅛ in (3 mm) less than the inside diameter of the ½ ft^3 (0.014 m^3) measure.

2.5 Procedure

a. From the coarse fraction in Test No. 1, Section 1.3c., separate a representative specimen of 45 lbs (20 kg) and weigh to 0.1 1b. (50 g), or less if using a balance that is more accurate than 0.1 lbs.

b. Split the specimen into five representative and approximately equal parts.

c. Place the specimen in the mold in five separate lifts after each lift is placed in the mold, position the piston on the specimen, mount the mold in the compactor, and compact as described in Table 2, Section 1.3h. Spacers between the load spring and piston must be used to adjust the elevation of the mold to the height of the lift being compacted.

d. After the final lift is compacted, remove the mold from the compactor, determine the height of the compacted specimen, and calculate the volume (see Test No. 1, Section 1.4(a)).

e. Calculate the dry density in lbs/ft^3 (kg/m^3) (see Test No. 1, Section 1.4(a)).

Test No. 3
Specific Gravity Determination for Theoretical Maximum Density Test

3.1 Equipment

a. Pycnometer calibrated at the test temperature having a capacity of at least 1 quart (100 ml).

b. One vacuum pump or aspirator (pressure not to exceed 100 mm mercury).

c. One balance accurate to 0.1 g.

3.2 Material

a. Fine fraction U.S. No. 4 (4.75 mm) minus 1.1 lbs (500 g) minimum.

b. Coarse fraction U.S. No. 4 (4.75 mm) plus 2.2 lbs (1,000 g) minimum.

3.3 Procedure

a. Place dry material, either fine or coarse fraction, in pycnometer, add water. Put pycnometer jar top in place and connect to vacuum apparatus. Apply vacuum for at a minimum of 20 minutes until air is removed from specimen. Slight agitation of the jar every 2 to 5 minutes will aid the de-airing process. If the material boils too vigorously, reduce the vacuum. Remove vacuum apparatus, fill pycnometer with water, dry outside of jar carefully and weigh. Water temperature during test should be maintained as close to 68° ± 1° F (20° ± 0.5° C) as possible.

Calculate Specific Gravity as follows:

$$\text{Sp. Gr.} = \frac{a}{a+b-c}$$

Where:

a = Weight of dry material, grams
b = Weight of pycnometer + water, grams
c = Weight of pycnometer + material + water, grams

3.4 Reports

a. All test results are recorded on the theoretical maximum density work sheet.

b. Use the appropriate computer program to determine the theoretical maximum density.

Idaho Standard Method of Test for

Disintegration of Quarry Aggregates (Ethylene Glycol)

Idaho IT-116-99

1. Scope

1.1. This method outlines the preparation and test procedure for measuring the presence of deleterious clay in quarry aggregates.

2. Reference

2.1. Standard Specifications, Subsection 703.01.

3. Apparatus

3.1. Oven 60 ± 2°C.

3.2. Sieves conforming to AASHTO M 92 Specifications.

4. Procedure

4.1. Wash and dry enough material passing the 12.5 mm and retained on the 9.5 mm sieve to provide 500 grams of material when shaken to refusal.

4.2. Immerse in technical grade ethylene glycol for a period of 15 days.

4.3. Decant and dry the aggregate. Shake to refusal over a 9.5 mm sieve and calculate the percent retained.

Idaho Standard Practice for

Investigation of Aggregate and Borrow Deposits

Idaho IR-142-06

1. Scope

1.1. This method sets forth the accepted procedures to be used in investigating sources of sand, gravel and rock for aggregates, borrow, and granular borrow for use in highway construction. It also includes accepted procedures for sampling, testing, and source plan development.

2. References

2.1. ITD Quality Assurance Manual.

2.2. ITD Materials Manual, Section 270.00, Materials Sources.

2.3. AASHTO T 2, Sampling of Aggregates, Appendix X2.

2.4. ASTM D 420-98, Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes.

2.5. ITD Standard Specifications for Highway Construction.

2.6. Idaho Code, Sections 54-2081 and 54-2802.

3. Terminology

3.1. For the purpose of this test method, the term "Contractor" shall be defined as any individual(s) or company interested in investigating a materials source with the intent of meeting Idaho Transportation Department specifications.

4. General

4.1. The Contractor shall comply with the provisions of ITD Standard Specifications, including requirements necessary prior to beginning any work or investigation with equipment within any source. Reference ITD Materials Manual, Section 270.13, Aggregate Materials Sources.

5. Investigation and Sampling

5.1. Materials source investigation and sampling shall include the following:

5.2. Sand and gravel deposits shall be investigated by excavating test pits located 150 ft. to 200 ft. (45 m to 60 m) on centers. The test pits shall be selected to form an effective grid over the entire area to be investigated. The test pits shall represent the materials present to the full depth intended to be mined. In lieu of test pits, large diameter drilling may be acceptable if the drilling method collects a representative sample and is submitted for pre-approval by the District Materials Engineer..

5.2.1. If the sand/gravel deposit has an exposed face, the Contractor may elect to replace the first row of test pits by sampling from the face. Sample locations shall be selected forming a grid pattern over the exposed face, and extending into the face to undisturbed material, to represent the area investigated. A minimum of three (3) sample locations shall be selected along any exposed face. Any source sampled at the face will require, in addition, a minimum of one (1) row of test pits at a maximum of 150 ft. (45 m) from the face. The test pits and samples shall represent the materials present to the full depth intended to be mined.

5.3. Rock deposits shall be investigated using core drilling equipment. Drill holes shall be spaced no more than 200 ft. (60 m) on center to form an effective grid covering the entire area investigated. Drill holes shall be deep enough to represent the full depth of the excavation.

5.3.1. Bulk samples may be taken from blasted areas in lieu of core drilling. The samples may be collected from the blasted rock pile if the blasted materials accurately represent the entire area investigated and the full depth of the excavation. Additional sampling and testing of the quarry face or core drilling shall be required if additional material is required beyond the materials represent ed by the blasting. Samples from blasted rock piles shall not be used to characterize the materials more than 200 feet (60 m) beyond the blasted rock face.

5.3.1.1. If the rock quarry has an exposed face, the Contractor may elect to replace the first row of rock cores by sampling from the face. Sample locations shall be selected forming a grid pattern over the exposed face and extending into the face to represent the area investigated. A minimum of three (3) sample locations shall be selected along any exposed face. Any source sampled at the face will require a minimum of one (1) row of rock cores at a maximum of 200 ft. (60 m) from the face. The rock cores shall represent the intended materials present to the full depth intended to be mined..

5.4. For project-specific sources consisting of either sand/gravel deposits or rock deposits, sample location spacing shall be adjusted to form an effective grid over the area to be worked. A minimum of three (3) samples shall be taken. The grid shall represent the intended depth of excavation, as well as the area to be worked, to produce the required quantities. Samples from an exposed face shall meet the requirements of Paragraph 4.1 or 4.2.

5.5. The investigator shall keep an accurate, detailed record of each sample, test pit, and boring location and detailed descriptions of all materials present in the proposed source. The detailed descriptions shall include but not limited to; geologic descriptions, scaled boring logs, and 4 inch by 5 inch minimum size color photographs of the materials, cores, and samples in the moist condition. Detailed descriptions of the source materials shall be made by direct, hands-on observations. Material descriptions taken from or referenced from published or non-published documents will not be accepted in lieu of a materials source investigation in accordance with this procedure but may be used to supplement the investigation. Descriptions of bedrock materials shall be provided by a qualified Professional Geologist. Clear copies of the original records shall be provided to the Engineer for source approval.

5.6. All investigations shall be performed under the direction of or by a qualified Professional Engineer or Professional Geologist licensed in the state of Idaho. All sample locations shall be selected by the Professional Engineer or Professional Geologist and shall be in accordance with the current version of AASHTO T 2, Sampling of Aggregates, Appendix X2; and ASTM D 420 Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes.

5.6.1. For the purpose of this test method, direct supervision shall include the Professional Engineer or Professional Geologist having intimate knowledge of the source so as to be able to determine the sample locations and sampling methods as well as sufficient knowledge of the site to meet the descriptive requirements herein.

5.7. Sampling shall be performed under the direct supervision of a qualified Professional Engineer or Professional Geologist licensed in the state of Idaho. Sampling procedures shall be performed in accordance with the current version of AASHTO T 2, Sampling of Aggregates, Appendix X2; and ASTM D 420-98, Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes. Though the actual sample size may vary due to the gradation of the materials being sampled, the minimum sample size shall be 100 lbs (50kg) and shall be representative of the aggregate being mined. Multiple samples may be required to accurately represent the distribution of materials in the source. Each sample shall represent one test. The entire sample shall be crushed, blended and split into appropriate portions for the tests required.

6. Testing

6.1. Required test data for aggregate sources shall conform to Standard Specifications Section 703 – Aggregates, and ITD Contract Specifications.

6.1.1. Required test data for borrow and granular borrow sources shall conform to Standard Specifications Section 205 – Excavation and Embankment, , and ITD Contract Specifications.

6.2. The laboratory used to perform the tests shall be qualified under the Idaho Transportation Department's Lab Qualification Program or be AASHTO accredited. All individuals that perform laboratory tests for source approval shall be qualified by the Registered Engineer in charge of the laboratory.

6.3. Copies of all test results shall be furnished by the independent laboratory to the Engineer. Consideration for source approval is contingent upon receiving complete source investigation test data from the independent laboratory.

7. Materials Source Plan

7.1. A Materials Source Plan shall be prepared and submitted to the Engineer. At a minimum, the plan shall contain the following:

7.2. A vicinity sketch in enough detail that the source can be located.

7.3. A legal description of the source.

7.4. A sketch of the source depicting the boundary dimensions and drawn to scale.

7.5. A north arrow.

7.6. The test pits, sample locations, borings, active or working faces shall be depicted on the sketch relative to their location in the source.

7.7. The area to be worked shall be delineated with test pits, sample locations, and borings representing the material shown.

8. Qualified Aggregate Material Suppliers

8.1. Upon completion of the requirements outlined in this test method, the Contractor's source may be included on the Idaho Transportation Department (ITD) list of Qualified Aggregate Materials Suppliers as defined in the ITD Quality Assurance Manual (Section 265.00, Qualified Aggregate Materials Suppliers).

Idaho Standard Method of Test for

Specific Gravity and Absorption of Fine Aggregate Using Automatic Vacuum Sealing (CoreLok) Method

Idaho IT-144-08

1 Scope

1.1 This standard covers the determination of specific gravity and absorption of fine aggregates.

1.2 The values are stated in SI units and are regarded as the standard units.

1.3 This standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 Referenced Documents

2.1 AASHTO Standards:

- M 132, Terms Relating to Density and Specific Gravity of Solids, Liquids and Gases
- M 231, Weighing Devices Used in the Testing of Materials
- T 2, Standard Practice for Sampling of aggregates
- T 19, Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate
- T 248, Standard Practice for Reducing Samples of Aggregate to Testing Size
- T255, Total Evaporable Moisture Content of Aggregate by Drying

2.2 Other Standards

- CoreLok Operational Instructions (InstroTek, Inc.)

3 Terminology

3.1 absorption—the increase in the mass of aggregate due to water in the pores of the material, but not including water adhering to the outside surface of the particles, expressed as a percentage of the dry mass. The aggregate is considered “dry” when it has been maintained at a temperature of 110 ± 5ºC for sufficient time to remove all uncombined water.

3.2 specific gravity—the ratio of the mass (or weight in air) of a unit volume of a material to the mass of the same volume of water at stated temperatures. Values are dimensionless.

3.3 apparent specific gravity—the ratio of the weight in air of a unit volume of the impermeable portion of aggregate at a stated temperature to the weight in air of an equal volume of gas-free distilled water at a stated temperature.

3.4 bulk specific gravity—the ratio of the weight in air of a unit volume of aggregate (including the permeable and impermeable voids in the particles, but not including the voids between particles) at a stated temperature to the weight in air of an equal volume of gas-free distilled water at a stated temperature.

3.5 bulk specific gravity (SSD)—the ratio of the mass in air of a unit volume of aggregate, including the mass of water within the voids filled to the extent achieved by vacuum saturating (but not including the voids between particles) at a stated temperature, compared to the weight in air of an equal volume of gas-free distilled water at a stated temperature.

4 Summary Of Method

4.1 Sufficient fine aggregate sample is dried to constant mass and representative dry fine aggregate samples of the same material are selected for testing. One sample is sealed in a vacuum chamber inside a plastic bag and opened under water for rapid saturation of the aggregate. The dry mass and submerged mass of the sample is used for calculation of apparent specific gravity. Other samples of the same aggregate are tested in a known volume metal pycnometer. The known mass of the pycnometer with water, mass of the dry aggregate, and mass of the dry aggregate and pycnometer filled with water is averaged and used for calculation of bulk specific gravity oven dry (OD.) The results from the samples tested are used to calculate absorption, and bulk specific gravity saturated-surface-dry (SSD).

5 Apparatus

5.1 Balance—A balance that conforms to AASHTO M231. The balance shall be sensitive, readable and accurate to 0.1% of the test sample mass. The balance shall be equipped with suitable apparatus for suspending the sample in water.

5.2 Water Bath—A large container that will allow for completely submerging the sample in water while suspended, equipped with an overflow outlet for maintaining a constant water level. Temperature controls may be used to maintain the water temperature at 25 ± 1° C (77 ± 2 °F).

> **Note 1**—It is preferable to keep the water temperature constant by using a temperature controlled heater. Also, to reduce the chance for the bag to touch the sides of the water tank, it is preferable to elevate the water tank to a level at which the sample can be placed on the weighing mechanism while the operator is standing up (waist height), and the placement of the sample and the bag in the water tank can easily be inspected.

5.3 Sample holder for water displacement of the sample, having no sharp edges.

5.4 Vacuum Chamber—with a pump capable of evacuating a sealed and enclosed chamber to a pressure of 6 mm Hg, when at sea level. The device shall automatically seal the plastic bag and exhaust air back into the chamber in a controlled manner to ensure proper conformance of the plastic to the specimen. The air exhaust and vacuum operation time shall be set at the factory so that the chamber is brought to atmospheric pressure in 80 to 125 seconds, after the completion of the vacuum operations.

5.5 A Vacuum Measurement Gauge, independent of the vacuum sealing device, that could be placed directly inside the chamber to verify vacuum performance and the chamber door sealing condition of the unit. The gauge shall be capable of reading down to 3 mm Hg and readable to ± 1 mm Hg. The gauge shall be NIST traceable.

5.6 Plastic Bags, used with the vacuum device, shall have a minimum opening of 235 mm (9.25 in.) and maximum opening of 260 mm (10.25 in.). The bags shall be of plastic material, shall be puncture resistant, and shall be impermeable to water. The bags shall have a minimum thickness of 0.127mm (0.005 in.). The manufacturer shall provide the apparent specific gravity for the bags.

5.7 Metal pycnometer and lid, with 137 ± 0.13 mm (5.375 ± 0.005 in.) inside diameter (ID) and 89 ± 0.41 mm (3.5 ± 0.016 in.) height, for testing fine aggregates. The pycnometer shall be machined to be smooth on all surfaces. The inside of the lid shall be machined at a 5° angle to create an inverted conical surface.

5.8 Pycnometer clamping device to hold and secure the lid on the metal pycnometer from lifting during fine aggregate tests. The device shall be provided with a level indicator.

5.9 Syringe with a needle no larger in diameter than 3 mm (0.125 in.)

5.10 Thermometer or other temperature device with range to 40ºC (100ºF) accurate to ±1º.

5.11 Isopropyl alcohol – Technical Grade

5.12 Accessories— A bag cutting knife or scissors, spray bottle for the isopropyl alcohol, a bucket large enough to allow the pycnometer to be fully submerged in water, water containers to dispense water into pycnometer during testing, small paint brush and 25 mm (1 in.) wide aluminum spatula.

---

6 Verification

6.1 System Verification: The vacuum settings of the vacuum chamber shall be verified once every 12 months and after major repairs and after each shipment or relocation.

6.1.1 Place the gauge inside the vacuum chamber and record the setting, while the vacuum unit is operating. The gauge should indicate a pressure of 6 mm Hg or less. The unit shall not be used if the gauge reading is above 6 mm Hg.

> **Note 2**— In line vacuum gauges, while capable of indicating vacuum performance of the pump, are not suitable for use in enclosed vacuum chambers and cannot accurately measure vacuum levels.

6.2 Calibration of Pycnometer:

6.2.1 Prior to testing, condition the pycnometer to 25 ± 1°C (77 ± 2°F) by placing it inside a bucket of water that is maintained at 25 ± 1°C (77 ± 2°F). Place the pycnometer clamping device on a level surface. Use a level indicator or the provided level to level the device.

> **Note 3 –** The clamping device must be protected from hot or cold ambient laboratory temperatures that are more or less than 25 ± 1°C (77 ± 2°F).

6.2.2 Remove the pycnometer from the water bucket and dry it with a towel. Place the pycnometer in the device and push it back until it makes contact with the stops.

6.2.3 Fill the pycnometer with 25 ± 1°C (77 ± 2°F) water to approximately 10 mm (0.375 in.) from the top. Using the alcohol spray bottle, spray the surface of the water to remove bubbles.

6.2.4 Gently place the lid on the pycnometer and close the clamps on the device.

6.2.5 Using a syringe filled with 25 ± 1°C (77 ± 2°F) water, slowly fill the pycnometer through the large fill hole on the lid post. Make sure the syringe tip is far enough in the pycnometer to be below the water level. Gentle application in this step prevents formation of air bubbles inside the pycnometer.

6.2.6 Fill the pycnometer until water comes out of the 3 mm (1/8-in.) hole on the surface of the lid.

6.2.7 Wipe any remaining water from the top of the lid with a towel.

6.2.8 Place the entire device with the pycnometer on the scale and record the mass. Record the mass to 0.1 in the top portion of the Aggregate Worksheet. (See Appendix 1)

6.2.9 Clean the pycnometer and repeat steps 6.2.1 to 6.2.8 two more times and average the calibration masses obtained in 6.2.8.

6.2.10 If the range for the 3 calibration masses is larger than 0.5 grams, then the test is not being run correctly. Check to see if the device is level. Make certain the water injection with the syringe is done below the pycnometer water surface and is applied gently. Check the water temperature. Check the pycnometer temperature. Repeat the above procedure until you have three masses that are within a 0.5 gram range.

6.2.11 The pycnometer must be re-calibrated daily prior to testing.

7 Sampling

7.1 Sampling shall be performed in accordance with AASHTO T 2.

7.2 Samples shall be dried to constant mass in accordance with AASHTO T255.

7.3 Samples shall be reduced in accordance with AASHTO T 248.

8 Procedures

8.1 Equipment Preparation:

> **Note 4 –** Make certain water temperature used for this test remains at 25 ± 1°C (77 ± 2°F).

8.1.1 Prior to testing, condition the pycnometer to 25 ± 1°C (77 ± 2°F) by placing it inside a bucket of water that is maintained at 25 ± 1°C (77 ± 2°F).

8.1.2 Remove the pycnometer from the water bucket and dry thoroughly with a towel.

8.1.3 Place the pycnometer clamping device on a level surface. Use a level indicator or the provided level to level the device.

8.1.4 Place the empty pycnometer in the pycnometer clamping device and push it back until it makes contact with the stops.

8.2 Determine Bulk Specific Gravity:

8.2.1 Oven dry to constant mass according to AASHTO T255, enough fine aggregate to obtain three 500 gram samples and one 1000 gram sample, reduced according to AASHTO T248..

8.2.2 Allow the sample to cool to 25 ± 1°C (77 ± 2°F).

8.2.3 Determine the mass of a 500 ± 1 gram dry sample, Trial 1, that is at 25 ± 1°C (77 ± 2°F) and record to 0.1 on the Aggregate Worksheet.

8.2.4 Steps 8.2.5 to 8.2.13 shall be completed in less than 2 minutes.

8.2.5 Place approximately 500 ml of 25 ± 1°C (77 ± 2°F) water in the pycnometer (halfway full).

8.2.6 Slowly and evenly pour the sample into the pycnometer. Make certain aggregate is not lost in the process of filling the pycnometer. Use a brush if necessary to sweep any remaining fines into the pycnometer. If any aggregate is lost during the process of filling the pycnometer, start the test over.

8.2.7 Use a metal spatula and push it to the bottom of the pycnometer against the inside circumference. Slowly and gently drag the spatula to the center of the pycnometer, removing the spatula after reaching the center. Repeat this procedure in eight equal increments until the entire circumference is covered. If necessary, use a squeeze water bottle to rinse any sample residue off the spatula into the pycnometer.

8.2.8 Fill the pycnometer with 25 ± 1°C (77 ± 2 °F) water to approximately 10 mm (0.375 in.) of the pycnometer rim. It is important the water level be kept at or below the 10 mm line to avoid spills during lid placement.

8.2.9 Use the spray bottle filled with isopropyl alcohol to spray the top of the water to remove air bubbles.

8.2.10 Gently place the lid on the pycnometer and lock the clamping device. Using the syringe, slowly fill the pycnometer through the center hole on top of the lid post. Make sure the syringe tip is far enough in the pycnometer to be below the water level. Gentle application in this step will prevent formation of air bubbles inside the pycnometer.

8.2.11 Fill the pycnometer until water comes out of the 3 mm (1/8-in.) hole on the surface of the lid.

8.2.12 Wipe any remaining water from around the 3 mm (1/8-in.) hole with a towel.

> **Note 5 –** Do not wipe water from the rim of the pycnometer if it seeps between the lid and the pycnometer. Allow this water to remain.

8.2.13 Determine the mass of the sample, the pycnometer and the device. Record the mass to 0.1 in B of the Aggregate Worksheet.

8.2.14 Discard the sample and prepare the equipment according to step 8.1.1 to 8.1.4.

8.2.15 Repeat steps 8.2.3 to 8.2.13 for another 500 ± 1 gram sample, Trial 2.

8.2.15.1 The difference in the mass of Trial 1 and Trial 2 recorded in B must be 1.0 gram or less. If the difference is greater than 1.0, then repeat steps 8.2.14 and 8.2.15 using another 500 ±1 gram dry sample.

8.2.16 Calculate the average mass for the two trials that are within 1 gram; record to 0.1 on Aggregate Worksheet.

8.2.17 Record the average weight of the pycnometer from section 6.2.9 on Aggregate Worksheet.

8.3 Determine Apparent Specific Gravity:

8.3.1 Set the vacuum device according to manufacturer's recommendation.

8.3.2 Tare the immersed weighing basket in the water bath.

8.3.3 Use a small plastic bag and inspect the bag to make sure there are no holes, stress points or side seal discontinuities in the bag. If any of the above conditions are noticed, use another bag.

8.3.4 Determine the mass of the bag and record to 0.1 on Aggregate Worksheet.

> **Note 6**—Always handle the bag with care to avoid creating weak points and punctures.

8.3.5 Determine the mass of a 1000 ± 1 gram sample of oven dry aggregate and record 0.1 at E on Aggregate Worksheet.

8.3.6 Place the sample in the bag. Support the bottom of the bag on a smooth tabletop when pouring the aggregate to protect against punctures and impact points.

8.3.7 Place the bag containing the sample inside the vacuum chamber.

8.3.8 Grab the two sides of the bag and spread the sample flat by gently shaking the bag side to side. Do not press down or spread the sample from outside the bag. Pressing down on the sample from outside the bag will cause the bag to puncture and will negatively impact the results. Lightly spray mist aggregates with high minus 75-μm (No. 200) sieve material to hold down dust prior to sealing.

8.3.9 Place the open end of the bag over the seal bar and close the chamber door. The unit will draw a vacuum and seal the bag, before the chamber door opens.

8.3.10 Gently remove the sample from the chamber and immediately (within 5 seconds) submerge the sample in the water bath equipped with a balance for water displacement analysis.

> **Note 7 -** It is extremely important the bag be removed from the vacuum chamber and immediately placed in the water bath. Leaving the bag in the vacuum chamber or on a bench top after sealing can cause air to slowly enter the bag and can result in low apparent specific gravity results.

8.3.11 Completely submerge the bag at least 2-inches below the surface of the water during cutting.

8.3.12 Make a small cut across the top edge of the immersed bag approximately 25 to 50 mm (1 to 2 in.).

8.3.13 Hold the immersed bag open at the cut for approximately 45 seconds allowing the water to freely flow into the bag. Allow any small residual air bubbles to escape. Do not shake or squeeze the sample, as these actions will cause the fines to escape from the bag.

8.3.14 After water has filled in, make another cut on the opposite side of the immersed bag approximately 25 to 50 mm (1 to 2 in.). Squeeze any residual air bubbles on top portion of the bag through the openings by running your fingers across the top of the bag. Do not completely remove any portion from the bag nor allow any portion of the bag to reach the surface of the water. Keep the sample and bag at least 2-inches below the surface of the water at all times.

8.3.15 Place the bag containing the sample in the immersed weighing basket to obtain the under water mass. Allow water to freely flow into the bag. Make certain the bag or the sample are not touching the bottom, the sides, or floating out of the water bath.

8.3.16 Allow the sample to stay in the water bath for a minimum of fifteen (15) minutes but not more than 20 minutes.

8.3.17 Record the submerged mass on the Aggregate Worksheet and wait one minute. If after this time the mass increases by more than one-gram, wait an additional five minutes. Record the mass and continue this process until the mass stops increasing.

9 Calculations

9.1 Test result calculations for percent absorption, apparent specific gravity and bulk specific gravity will be obtained from the software supplied by the manufacturer. Use the data from the Aggregate Worksheet. The software will provide a report of the test results.

9.2 The final test result will be determined from an average of two laboratory specimens.

Appendix 1

Aggregate Worksheet

Weight of pycnometer and clamping device filled with water.					1.	2.	3.	Avg.
Sample Number or Label	Trial Number		**A** Dry Sample Mass (500 g)	**B** Mass of pycnometer with sample and water (g)	**C** Plastic bag mass (g)	**D** Mass of two rubber sheets (g)	**E** Dry Sample Mass (1000 g)	**F** Mass of Sealed sample opened under water
	1							
	2							
	3*							
	Avg							
	1							
	2							
	3*							
	Avg							
	1							
	2							
	3*							
	Avg							

* Trial 3 is only necessary if the mass in B for the first 2 trials is larger than 1.0 grams.

PERFORMANCE EXAM CHECKLIST

SPECIFIC GRAVITY AND ABSORPTION OF FINE AGGREGATE USING AUTOMATIC VACUUM SEALING (CORELOK) METHOD
IDAHO IT-144-08

Participant Name______________________________________ Exam Date______________

Record 'P' For Passing "F" for failing each step of the checklist.

Verification Element	**Trial 1**	**Trial 2**
1. Pycnometer and lid placed inside a bucket of water at 25°± 1C (77°± 2F)?	______	______
2. Pycnometer and lid removed from water dried well and placed on clamping device until it makes contact with stops?	______	______
3. Pycnometer filled with 25°± 1C (77°± 2F) water to 10mm (3/8") of top, sprayed with Isopropyl alcohol to remove air?	______	______
4. Lid gently placed on Pycnometer and clamped?	______	______
5. A syringe filled with 25°± 1C (77°± 2F) inserted in top of lid and gently added until water is expelled through the 3mm (1/8") hole?	______	______
6. Water wiped from lid, device water and pycnometer weighed and recorded to 0.1 g?	______	______
7. Procedure repeated two additional times (no greater than 0.5 g difference) recorded to work sheet and averaged?	______	______

Procedure Element	**Trial 1**	**Trial 2**
8. Representative samples obtained per FOP for AASHTO T 2?	______	______
9. Reduced per FOP for AASHTO T 248?	______	______
10. Dried per FOP for AASHTO T 255?	______	______
11. Samples cooled to 25°±1C (77°± 2F)?	______	______
12. Three samples obtained @ 500g ±1g and one @ 1000g ± 1g?	______	______
13. Pycnometer and lid removed from water, dried and pycnometer placed on clamping device until it makes contact with stops?	______	______
14. Water added to pycnometer (at 25°± 1C, 77°± 2F) to approximately half full?	______	______

Procedure Element	Trial 1	Trial 2
15. Sample at 500 g ± 1g slowly added to pycnometer?	______	______
16. Metal spatula inserted against side of pycnometer and slowly pushed to center removed, repeated in eight equal increments?	______	______
17. Water added at 25°± 1C (77°± 2F) to within 10mm (3/8”) of rim?	______	______
18. Sprayed with isopropyl alcohol to remove air?	______	______
19. Lid gently placed on pycnometer with 3mm (1/8”) hole to the front and clamped?	______	______
20. Syringe filled with 25°± 1C (77°± 2F) water inserted in top of lid and water slowly added until it is expelled through 3mm (1/8”) hole?	______	______
21. Excess water wiped from lid?	______	______
22. Clamping device, pycnometer and sample mass recorded to 0.1 g?	______	______
23. Clamping device, pycnometer and sample mass determined no more than 2 minutes from time sample was submerged?	______	______
24. Second 500g ±1 g sample tested and mass recorded?	______	______
25. If recorded mass of first and second sample greater than 1 g, was a third 500 g ± 1 g sample tested?	______	______
26. Vacuum device set at manufacture’s recommended setting?	______	______
27. Small plastic bag inspected and mass determined to 0.1 g and recorded?	______	______
28. 1000 g ±1 g sample mass determined and recorded?	______	______
29. 1000 g ±1 g sample placed in the bag, supported by a smooth surface to prevent punctures?	______	______
30. Sample placed in vacuum device and spread flat by grasping both sides of bag and gently shaking?	______	______
31. Open end of bag placed over seal bar and closed?	______	______
32. Sample removed from vacuum chamber when door opens and submerged in 25°± 1C (77°± 2F) water bath within 5 seconds?	______	______
33. Bag maintained at a minimum depth of two inches?	______	______
34. A small cut made at corner of bag approximately 25 to 50mm (1” to 2”)?	______	______
35. Submerged bag held open until water flows freely into bag (approximately 45 seconds)	______	______

Procedure Element	**Trial 1**	**Trial 2**
36. A second cut approximately 25 to 50mm (1” to 2”) made to opposite side of bag?	______	______
37. Residual air removed from bag by running fingers across top of submerged bag?	______	______
38. Bag placed in weighing basket and water allowed to flow freely into bag?	______	______
39. Sample mass determined and recorded after 15 minutes but not more than 20 minutes and recorded to 0.1g?	______	______
40. Test data entered into manufacture’s software to obtain test results?	______	______

COMMENTS: First Attempt : Pass ☐ Fail ☐ Second Attempt: Pass ☐ Fail ☐

Examiner Signature:_________________________________ Sampler / Tester Qualification # __________

Examiner Signature:__________________________________ Sampler / Tester Qualification # __________

Idaho Standard Practice for

Design of Seal Coats and Single Surface Treatments

Idaho IR-60-98

1. Scope

1.1. This method describes the procedures involved in obtaining the data necessary to design a seal coat or single surface treatment using a method developed by Jerome Kearby of the Kansas Asphalt Association.*

2. Apparatus

2.1. U.S. Series sieves as required to obtain a sieve analysis of cover coat aggregate.

5/8 in. (16.0 mm)
1/2 in. (12.5 mm)
3/8 in. (9.5 mm)
No. 4 (4.75 mm)
No. 8 (2.36 mm)

2.2. A 1/2 ft^3 (0.014 m^3) measure conforming to the requirement of AASHTO T 19.

2.3. A 1 yd^2 (1 m^2) test board made of plywood or masonite with sides framed by 1/2 in. (12 mm) molding strips.

2.4. Balance that is accurate to 1 g (triple beam balance).

3. Procedure

3.1. Determine the gradation of the aggregate by means of AASHTO T 27, Sieve Analysis of Fine and Coarse Aggregates.

3.2. Determine the average particle size of the aggregate.

*"Tests and Theories on Seal Coats or Asphalt Surface Treatments," by Jerome P. Kearby, Engineer Director, Kansas Asphalt Association, Topeka, Kansas.

"Tests and Theories on Penetration Surfaces," by Jerome P. Kearby, Proceedings of the 32nd Annual Meeting, H.R.B., 1953.

3.2.1. The material passing any given sieve size and retained on the next smaller size will have an average particle size approximately equal to the average of the two (2) sieve sizes. For example:

Sieve Size	Average Size
3/4 in. (19.0 mm)	
	10/16 in. (15.75 mm)
1/2 in. (12.5 mm)	
	7/16 in. (11.00 mm)
3/8 in. (9.5 mm)	
	4.5/16 in. (7.13 mm)
No. 4 (4.75 mm)	
	2/16 in. (3.56 mm)
No. 8 (2.36 mm)	
	1/16 in. (1.77 mm)
No. 16 (1.18 mm)	

3.2.2. The amount of each size material in the sieve analysis is that which passes one (1) sieve and is retained on the next smaller sieve. This value is obtained by subtracting the percent passing the smaller sieve from the percent passing the larger sieve. For example:

Sieve Size	% Passing	% Each Size
1/2 in. (12.5 mm)	100	
		15
3/8 in. (9.5 mm)	85	
		65
No. 4 (4.75 mm)	20	
		17
No. 8 (2.36 mm)	3	
		1
No. 16 (1.18 mm)	2	

3.2.3. In order to determine the average particle size of any given aggregate, the percent of each size (as obtained in paragraph 3.2.2) is multiplied by the average particle size between sieves (as obtained in paragraph 3.2.1) and the sum of the products is figured. For example:

Sieve Size	Average Size		% Each Size Expressed as Decimal		
1/2 in. (12.5 mm)	7/16 in. (11.00 mm)	X	.15	=	05/16 (1.6)
3/8 in. (9.5 mm)	4.5/16 in. (7.13 mm)	X	.65	=	2.9/16 (4.6)
No. 4 (4.75 mm)	2/16 in. (3.56 mm)	X	.17	=	0.34/16 (0.6)
No. 8 (2.36 mm)	1/16 in. (1.77 mm)	X	.03*	=	0.03/16 (0.0)
			Sum of Products		4.3/16 (6.8)

The average particle size = 4.3/16 in. (6.8 mm).

*The computation is generally carried only through the No. 8 sieve.

3.2.4. A simplified method of obtaining the average size is by the use of Figure 1 (page 4). On this chart, the percent passing may be plotted and the average size read at the point where the gradation line crosses the "50% passing" line. For example, plot the gradation of the aggregate on the chart. From the point where the gradation line crosses the "50% passing" line, drop vertically to the effective size. The average particle size thus obtained is 0.27 in. (6.8 mm). The average particle size is equal to and interchangeable with the Effective Mat Thickness as calculated in the following examples.

3.3. Determine the "spread ratio" by dividing 36 in. (1000 mm) by the average particle size:

<u>English</u>

36/4.3 ÷ 16 = 134, or 1 yd^3 aggregate per 134 yd^2 surface. 1:134 is the spread ratio.

<u>Metric</u>

1000 ÷ 6.8 = 147, or 1 m^3 aggregate per 147 m^2 surface. 1:147 is the spread ratio.

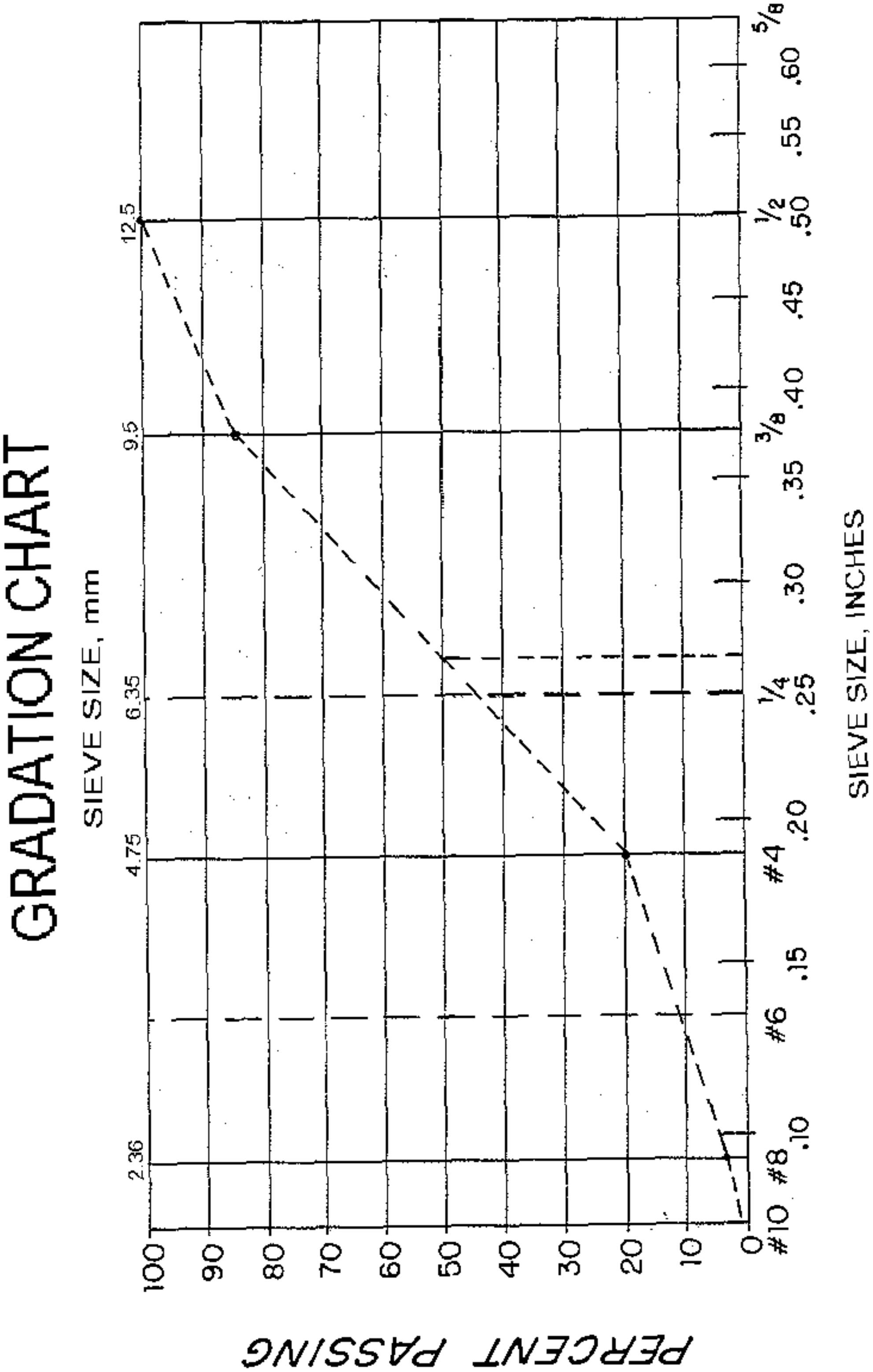

GRADATION CHART
SIEVE SIZE, mm
2.36
4.75
6.35
9.5
12.5
PERCENT PASSING
100
90
80
70
60
50
40
30
20
10
0
#10
#8
.10
#6
.15
#4
.20
1/4
.25
.30
.35
3/8
.40
.45
1/2
.50
.55
.60
5/8
SIEVE SIZE, INCHES

Figure 1

3.4. Determine the effective mat thickness by dividing 36 in. (1000 mm) by the number of yd^2 (m^2) covered by 1 yd^3 (1 m^3) of aggregate.

English

36 ÷ 134 = 0.27 in. effective mat thickness.

Metric

1000 ÷ 147 = 6.8 mm effective mat thickness.

3.5. An alternate method of arriving at the effective mat thickness is called the "test board method" and it eliminates the steps in Paragraphs 3.2 and 3.3.

- Using a 1 yd^2 (1 m^2) test board, place on the board a quantity of aggregate sufficient to obtain full coverage one (1) stone thick. Weigh this quantity of aggregate.
- Determine the loose weight of the aggregate [lb/yd^3 (kg/m^3)] by the method of AASHTO T 19.
- To obtain the spread ratio, divide the lb/yd^3 (kg/m^3) as determined in Paragraph 3.5.2 by the lb/yd^2 (kg/m^2) from Paragraph 3.5.1.
- Determine the effective mat thickness as specified in paragraph 3.4.

3.6. Determine the percent voids in the aggregate by dividing the loose unit weight in lb/ft^3 (kg/m^3) by the absolute unit weight, expressing the ratio as a percentage, and subtracting this value from 100. For example:

English

Given Loose Weight	=	93 lb/ft^3
Specific Gravity	=	2.70
% Voids	=	100 – [(93 x 100) ÷ (62.4 x 2.70)] = 45

Metric

Given Loose Weight	=	1490 kg/m^3
Specific Gravity	=	2.70
% Voids	=	100 – [(1490 x 100) ÷ (1000 x 2.70)] = 45

3.6.1. The rate of asphalt application can be calculated using the following formula:

$$Ra = C \times Em \times Te \times V$$

Where C is a constant 1.000 (5.61) found as follows:

1,296 in^2/yd^2 ÷ 231 in^3/gal. or 5.61 gal. ÷ in. · yd^2

(10,000 cm^2/m^2 ÷ 1000 cm^3/L or 10 L ÷ cm · m^2
or 10 L ÷ 10 mm · m^2 or 1.000 L ÷ mm · m^2)

Em = % Embedment ÷ 100

Te = Effective Mat Thickness, in. (mm)

V = % Voids ÷ 100

3.6.2. Ra from this formula is for asphalt cement. For cutback, multiply Ra by 1.11 to allow for volatiles. For emulsion, multiply Ra by 1.43 to allow for water.

Recommended embedment is as follows:

Average Mat Thickness	% Embedment
1/8 in. to 3/8 in. (3 mm to 9.5 mm)	30
1/2 in. (12.5 mm)	35
5/8 in. (16 mm)	40

3.7. Having determined the theoretical asphalt application in gal/yd^2 (L/m^2) in paragraph 3.6, calculate the aggregate application in lb/yd^2 (kg/m^2) from the spread ratio as shown below:

English

Spread Ratio = 1:134 or 1 yd^3 for 134 yd^2

$$\frac{lb.}{yd^2} = \frac{93\ lb.}{ft^3} \quad \frac{27\ ft^3}{yd^3} \quad \frac{1\ yd^3}{134\ yd^2} = 19$$

Metric

Spread Ratio = 1:147 or 1 m^3 for 147 m^2

$$\frac{kg}{m^2} = \frac{1490\ kg}{m^3} \quad \frac{1\ m^3}{147\ m^2} = 10$$

4. Tables

4.1 Table 1 is a guide to the classes of cover coat material which, as indicated by experience, perform most satisfactorily with each of the several types and grades of asphalt. This table is a convenient, rule-of-thumb reference.

Table 1

Grade of Asphalt / Type	Cover Coat Aggregate				
	1	2	3	4	Sand
MC-70					x
MC-250				x	x
MC-800		x	x	x	
MC-3000	x	x	x		
RC-70					x
RC-250					x
RC-800 & RC-800 DN		x	x		
RC-3000 & RC-3000 DN	x	x	x		
200-300	x	x	x		
120-150	x	x			
RS-2		x	x		
RS-3K		x	x		
SS-1h					x

4.2 Table 2 gives estimated values for the amount of several classes of cover coat aggregate that should be used to obtain a cover of one (1) stone thickness on the road. It should be understood that these figures are estimates based upon average physical characteristics of materials currently being used.

It must be understood that Table 2 is to be used as a guide in estimating seal coat quantities only when it is not possible to obtain the data necessary to compute these quantities using the above method.

Table 2

Quantity of Aggregate for
Retention of One (1) Stone Thickness

Cover Coat Aggregate	lb/ft^3 (kg/m^3)	lb/yd^2 (kg/m^2)	ft^3/yd^2 (m^3/m^2)
Type 1	96 (1540)	26 (14)	0.25 (0.0085)
Type 2	90 (1440)	20 (26)	0.20 (0.0068)
Type 3	94 (1500)	17 (9)	0.16 (0.0054)
Type 4	125 (2000)	30* (16*)	0.23 (0.0078)
Sand	100 (1600)	10 (5)	0.10 (0.0034)

*Inverted penetration treatment. Estimate very approximate.

Idaho Standard Method of Test for

Sampling and Viscosity Testing Emulsified Asphalt Binders in the Field

Idaho IT-61-08

1. Scope

1.1. This method covers field sampling and field testing of emulsified asphalt binders used for seal coats. Testing is performed using the Saybolt Furol Viscometer.

2. References

2.1. AASHTO T 40, Sampling Bituminous Materials

2.2. AASHTO T 72, Saybolt Viscosity.

2.3. AASHTO T 59, Testing Emulsified Asphalts (“Consistency” – “Viscosity”, Sections 34-38)

3. Apparatus

3.1. Saybolt Furol Viscometer with Bath, conforming to the requirements of AASHTO T 72 with an oil or water bath capable of maintaining the required testing temperature.

3.2. Receiving Flask- see figure# 1

3.3. Sieve – No. 20 (850 µm) sieve or a 20-mesh strainer of wire cloth framed or unframed.

3.4. Thermometers – ASTM No. 19°F or 19°C for tests at 122°F (50°C) conforming to the requirements of ASTM No. E1.

3.5. Thief Sampling Device – Capable of obtaining a sample from mid-depth of tanker/ tank.

3.6. Timer – Capable of measuring to the nearest 0.1 second.

3.7. Sample Can - 1-quart (1 liter) small-mouth

3.8. Plastic Jar- 1-quart (1 liter) wide mouth.

3.9. Sample bottle -8 fl. oz. (265 mL) plastic dairy bottle

3.10. Sample bottle Stopper- with an opening to insert a dial thermometer through it and sized to fit the opening in the dairy bottle

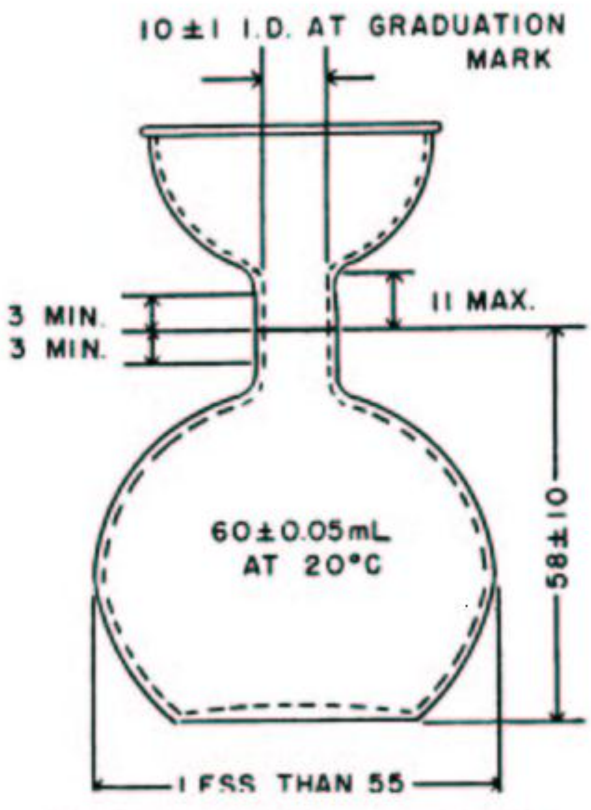


Figure #1: Receiving Flask

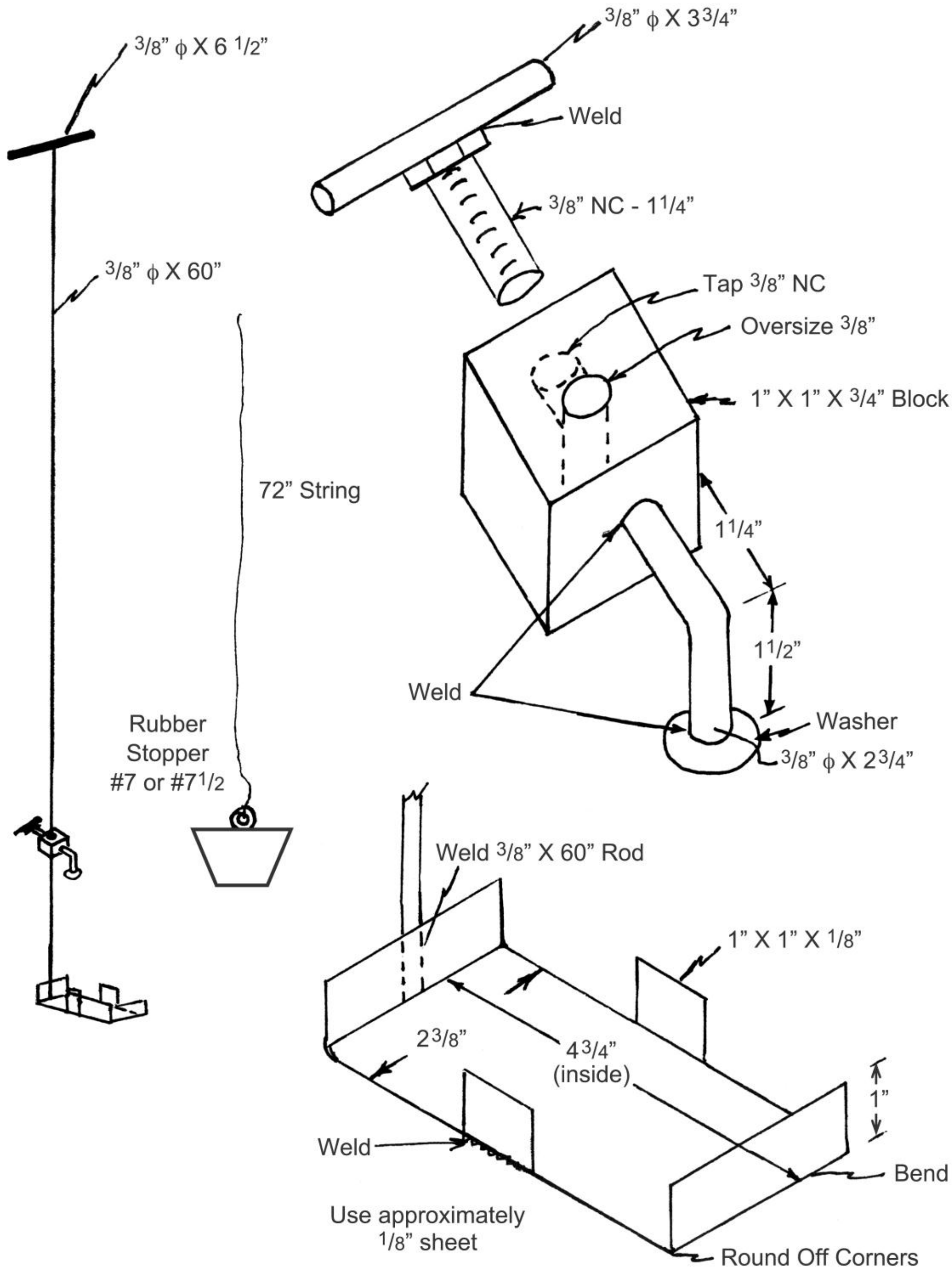


Figure #2: Thief Sampling Device (Dip method Device)

4. Sampling:

4.1. The emulsified asphalt binder sample may be obtained by either of two methods. These methods are covered in AASHTO T 40 but will also be covered here. They are; the "Valve method" and "Thief Method." Samples shall be obtained before any material is unloaded.

Note#1: A safe means of sampling shall be provided by the contractor / supplier. With the "Thief method" proper fall protection must be provided.

4.1.1. Valve Method: A recommended design for the valve is shown in AASHTO T 40.

4.1.1.1. In order to clear the line, draw and discard 4 L (1 gal) of emulsified Asphalt using a valve located in the center of the tank.

4.1.1.2. After clearing the line, immediately draw the emulsified Asphalt sample into a large mouthed 1 L (1 quart) plastic jar.

4.1.2. Thief Method (Dip Method): This method shall only be used when a truck tanker or distributor does not have a valve available to obtain the sample.

4.1.2.1. Attach the 1 L (1 quart) can at the bottom of the Thief device (see figure# 2). Stopper the can with a # 7 or #71/2 rubber stopper. The stopper shall have a way to remove it from the can once the can has been submerged on the thief device.

Note # 2: Before sampling, a careful observation of the material shall be made to detect the presence of foam or free water on top of the load. Care should be taken to immerse sampling device deep enough to pass through any foam or free water that may exist on top of material.

4.1.2.2. Lower the attached stoppered 1 L (1 quart) can to mid-depth of the tanker/ tank.

4.1.2.3. Pull the stopper from the can. Allow the can to fill.

4.1.2.4. Withdraw the Thief device along with the sample and sample can from the tanker/ tank.

4.2. Immediately transfer approximately 204 mL (6 to 7 oz.) of emulsified asphalt into a 265 mL. (8 fl. oz) plastic dairy bottle. Seal the container securely to eliminate the chance of evaporation of water in the sample with a rubber stopper having a small dial thermometer through its center.

Note# 3: It is recommended that while the sample is cooling for testing clean the thief device and can stopper.

5. Testing

5.1. Preheat the Sabolt Furol Viscometer bath to testing temperature 50 ± 0.05°C (122 ± 0.09°F).

5.2. Insure that the brass viscometer tube is clean and dry and that the cork inserted into the bottom of the tube.

5.3. Cool the emulsified asphalt sample to 51.7 ±0.3°C (125 ±0.5°F).

Note# 3: The bottom of the sealed plastic bottle containing the emulsified asphalt sample may be immersed into a cold-water bath to cool it more quickly. Insure that thermometer is not touching the bottom of the bottle.

5.4. Once cooled, immediately pour the emulsified asphalt through a No. 20 (850 mm) sieve and into the brass viscometer tube until the sample is above the overflow rim.

5.5. Stir the emulsified asphalt sample in the brass viscometer tube at 60 RPM with a thermometer until it is at a temperature of 50°C ± 0.3°C (122°F ± 0.5°F). Avoid bubble formation while stirring. Once the test temperature is attained, withdraw the thermometer.

5.6. Place the tip of a suction pipette into the viscometer tube gallery. The gallery is the area where the overflow is contained. Quickly remove the excess emulsified asphalt from the gallery until the level in the gallery is below the overflow rim. Remove the pipette without touching the overflow rim.

5.7. Immediately cover the top of the viscometer tube.

5.8. Place the receiving flask in the proper position under the viscometer tube. Proper placement will insure that the sample will roll down the inside lip of the receiving flask.

5.9. Remove the cork from the viscometer tube and immediately start the timer.

5.10. Stop the timer when the emulsified asphalt meniscus bottom reaches the graduation mark.

5.11. Clean the viscometer tube, screen, cork, thermometer, and receiving flask.

5.12. If the initial tanker / tank sample fails to meet specified limits, a second sample will be obtained using the "Thief Method." When the test results on the second sample also fail to meet specifications the tanker / tank will be rejected.

6. Report

6.1. Record the results to the nearest 1 second.

6.2. Results shall be reported on an ITD-1045, Sample Data Sheet Emulsified Asphalt and Cutbacks.

QUALIFICATION CHECKLIST

FIELD VISCOSITY – IDAHO IT 61

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element		Trial 1	Trial 2
Sampling			
1. Sample taken using a valve:			
a. Minimum of 4 L (1gal) allowed to flow before sample taken?	1a	________	________
b. Sample taken in clean 1 L (1 quart) wide mouth jar?	1b	________	________
2. Sample taken with Thief device.			
a. Sample can immersed approximately to middle of tanker?	2a	________	________
b. Rubber stopper removed from can and sample taken from the middle of the tanker / tank?	2b	________	________
3. A portion of the sample transferred to a one (1) half pint plastic bottle and sealed with a stopper having a thermometer in the center?	3	________	________
Equipment			
4. Temperature of the viscometer bath at 50ºC (122°F)?	4	________	________
5. Viscosity tube clean and dry and cork installed?	5	________	________
Testing			
6. Sample cooled to 51.7 ±0.3°C (125 ±0.5°F)?	6	________	________
7. Sample poured through a #20 sieve prior to entering the brass viscosity tube?	7	________	________
8. Enough sample poured into the tube to allow overflow into gallery?	8	________	________
9. Thermometer placed into tube and sample stirred slowly until testing temperature reached?	9	________	________
10. Thermometer withdrawn and excess in the overflow gallery siphoned out using a pipette without touching overflow rim?	10	________	________
11. Emulsified asphalt sample in viscometer immediately covered?	11	________	________
12. Cork pulled allowing the sample roll down the inside lip of the receiving flask?	12	________	________
13. Timer immediately started when cork is pulled?	13	________	________
14. Timer stopped when bottom of sample meniscus reaches graduation mark?	14	________	________
15. Test results reported to nearest 1 second on ITD-1045 form?		________	________

First Attempt: Pass ☐ Fail☐ Second Attempt: Pass☐ Fail ☐

Comments:____

Participant Name ___________________________Exam Date ______________WAQTC#____________

Examiner's Name: _______________________________ Signature _________________________

WAQTC #:_______________

Idaho Standard Method of Test for

Determining the Percent of Coated Particles in Bituminous Mixtures

Idaho IT-96-98

1. Scope

1.1. The intent of this test is to establish a length of mixing time for the operation of a bituminous mixing plant. The method is based on the premise that the coarse aggregate is the most difficult and last to coat with asphalt. The aim is the least mixing time cycle that will produce a mix in which a minimum of 95% of the coarse aggregate particles are completely coated and all other specifications are satisfied.

2. Apparatus

2.1. Sieves – One (1) or more box-type screens of the size required for the mix.

2.1.1. For 1/2 in. (12.5 mm) maximum size aggregate, a No. 4 (4.75 mm) screen may be used.

2.1.2. For 1/2 to 1 in. (12.5 to 25.0 mm) maximum size aggregate, a 3/8 in. (9.5 mm) screen may be used.

2.1.3. For plus 1 in. (25.0 mm) maximum size aggregate, a 1/2 in. (12.5 mm) screen may be used.

2.2. Sample pan or trays.

2.3. Sample scoop or shovel.

2.4. Several sheets of manila paper, approximately 24 in. x 36 in. (600 mm x 900 mm).

2.5. Flood lamps, if required.

2.6. Stiff wire brush.

2.7. Small spatula.

2.8. Solvent and cleaning rags.

3. Procedure

3.1. Permit the plant to operate at an established mixing time per batch (timed by stop watch).

3.2. Take a sufficiently large sample to obtain a coarse fraction count of from 200 to 500 coarse particles. This will generally require from 5 to 8 lb. (2.5 to 4 kg) of plant mix.

3.3. Three (3) separate samples shall be obtained from material produced under identical conditions, immediately after discharge from the pug mill.

3.4. Sieve the samples immediately, while they are still hot, through the proper size sieve. Do not overload the sieves. If necessary, sieve each sample in two (2) or three (3) operations. Shaking should be reduced to a minimum to prevent coating of uncoated particles.

4. Calculations

4.1. Spread the coarse particles on a sheet of manila paper and very carefully examine each particle. Any particle that has a spot (even pinpoint size) which is not coated, is counted as uncoated.

4.2. Group the counted particles, placing the uncoated ones on one side and the coated ones on the other side.

4.3. Counting in normal daylight is the best, but a flood light may be used if necessary.

4.4. The percentage of coated and uncoated particles is obtained by dividing each group by the total number of particles.

5. Report

5.1. In all samples, the number of coated particles must be 95% or above. If the count is below 95%, the mixing time shall be increased in increments and additional counts made until the count rises to 95% or more.

Idaho Standard Method of Test for

Detection of Anti-Stripping Additive in Asphalt

Idaho IT-99-08

1 Scope

1.1 This method covers field procedures for verifying the presence of anti-stripping additive in asphalt. This test is qualitative only and does not indicate percentage of anti-strip.

2 Summary and Significance of Method

2.1 A small amount of asphalt is heated in a solution of Isopropyl Alcohol. The decanted alcohol is tested with an indicator of Bromophenol Blue. A visual color change indicates the presence of anti-stripping additive of organic compounds classified as amines. Use only clean containers and fresh chemical solutions, since water and other contaminants may cause a misleading color change.

3 Apparatus

3.1 Stove or hotplate.

3.2 Glass beakers of approximately 1.7-oz. (50 ml) capacity or disposable aluminum cups of approximately 4-oz. (120 ml) capacity.

3.3 Glass stirring rods or new disposable wooden stirring sticks approximately 6 in. (150 mm) long.

4 Reagents

4.1 Reagent Grade Isopropyl Alcohol (99.7% water free, minimum), a flammable solvent.

Do not store alcohol in any other bottles or cans – keep in the original container. Do not pour unused alcohol back into the original container.

4.2 Bromophenol Blue Indicator having a concentration of 0.2% in Isopropyl Alcohol (99.99% water free). The indicator, a flammable solution, should be a clear, orange color and not more than two (2) years old. The indicator and alcohol can be obtained from the Central Materials Laboratory.

5 Sample

5.1 The test sample should be taken in accordance with the sampling methods described in AASHTO T 40. However, a small, quick sample may be obtained by inserting a clean wooden lath into the load of asphalt, withdrawing the lath, and dripping the excess asphalt into a disposable aluminum cup.

6 Procedure

Note: Keep any water source or steam away from the testing area because water will alter the test results.

6.1 Control Blank. **Add** 1.35 oz. (40 ml) of Reagent Isopropyl Alcohol to a 1.7-oz. (50 ml) glass beaker or a 4 oz. aluminum cup.

6.2 Test Sample. Place approximately 1 g of asphalt to be tested into another 1.7-oz. (50 ml) beaker or an aluminum cup and add 1.35 oz. (40 ml) of Reagent Isopropyl Alcohol (1 g is about the size of a quarter and can be placed in the container with a glass rod or a wooden stick).

6.3 Warm the control blank on a hotplate until small bubbles appear. Remove beaker from hot plate and add a drop of the Bromophenol Blue Indicator and stir. Continue adding drops (normally 3-5 drops) and stirring until the control blank has turned a definite yellow color. (Be extremely cautious around open flame, as the Isopropyl Alcohol is flammable). If the liquid in the control blank is any other color than yellow, contamination has occurred. If contamination is suspected, clean the testing equipment with the Reagent Isopropyl Alcohol prior to re-testing. If contamination continues to be suspected, obtain new alcohol and replace equipment if necessary prior to re-testing.

6.4 Warm the test sample until the liquid portion becomes approximately the same shade of yellow as the control blank. Pour the liquid portion of the mixture into a clean 1.7 oz. (50 ml) beaker or disposable aluminum cup. Immediately add the same number of drops of Bromophenol Blue Indicator as was added to the control blank and stir.

Stop heating before the mixture becomes too dark, since this will interfere with the color interpretation. After heating, remove the 1.7-oz. (50 ml) beakers a safe distance from the hotplate or flame.

6.5 The presence of an anti-stripping additive is verified when the test liquid turns blue. Any other color change, including light green color, is not a positive reading.

7 Report

7.1 Report blue color as positive; report any other color change as negative.

QUALIFICATION CHECKLIST

DETECTION OF ANTI-STRIP ADDITIVE IN ASPHALT – IDAHO IT 99

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element		Trial 1	Trial 2
General			
1. All containers and or stir sticks were clean and chemical solutions were fresh.	1	____	____
Detection test by Color Method only			
2. A control blank was performed.	2	____	____
3. 40ml of Reagent Isopropyl Alcohol or equivalent was used.	3	____	____
4. The asphalt mixture was heated on a hot plate.	4	____	____
5. Heating of sample was stopped before mixture became too dark.	5	____	____
6. The same amount of Bromophenol Blue Indicator was added to both mixtures.	6	____	____
7. Test results were accurately interpreted and recorded on the proper ITD form. (Blue color as positive; report any other color change as negative).	7	____	____

Comments: First Attempt: Pass ☐ Fail ☐ Second Attempt: Pass ☐ Fail ☐

Testing Technician's Name: ______________________________ WAQTC # : __________ Date: _________

Examiner's Name: ______________________________ Signature ______________________________

Idaho Standard Practice for

Acceptance Test Strip for Hot Mix Asphalt (HMA) Pavement

Idaho IR-125-11

1 Scope

1.1 This Standard Practice is used to:

- obtain density gauge readings to establish density gauge correlation factors (State and Contractor)
- obtain cores for determining the density gauge correlation factors
- obtain loose mix samples for test strip acceptance testing (Contractor)
- obtain cold feed aggregate samples for test strip acceptance testing (Contractor)
- confirm the HMA can be compacted to the minimum of 92.0% but not in excess of 96.0% density
- develop a roller pattern to achieve the specified density

2 Reference Documents

2.1 AASHTO

FOP for T 168 - Sampling Bituminous Paving Mixtures

T 2 - Sampling of Aggregates

FOP for AASHTO T 343 – Method C, Density of In-Place Hot Mix Asphalt (HMA) Pavement by Electronic Surface Contact Devices

2.2 WAQTC

TM 8 - In Place Density of Bituminous Mixes Using the Nuclear Moisture-Density Gauge (Backscatter Mode)

TM11 - Field Sampling Bituminous Material after Compaction (Obtaining Cores)

3 Apparatus

3.1 Sampling device as specified in FOP for AASHTO T 168

3.2 Density gauge with accessory equipment as specified in WAQTC TM 8 or FOP for AASHTO T 343.

3.3 Coring equipment for collecting six-inch diameter pavement cores

3.4 Approved measuring device capable of measuring test strip length. All apparatus shall be furnished by the Contractor.

4 Terminology

4.1 Acceptance Test Strip - One or more Test Sections, the total length not less than 1,000 feet or more than 2500 feet. The Acceptance Test Strip shall be constructed to the same placement width and thickness as the course it represents. (Figure 1)

4.2 Test Section - a minimum of 500 feet (continuous) in length within the Acceptance Test Strip, constructed with a single asphalt binder content. A separate Test Section is required for each asphalt binder content used in the Acceptance Test Strip. (Figure 1)

4.3 Roller Pass Density - an uncorrected density reading determined using a density gauge in backscatter mode following a roller pass. The Roller Pass Density shall consist of one one-minute count with the density gauge placed parallel to the direction of travel. Filler material is not required and a core correlation will not be applied to these density readings.

4.4 Maximum Roller Pass Density - the uncorrected density reading following the roller pass which adds no more than 1/2 pound per cubic foot (8 kg/m^3) to the previous density value. This shall be accomplished during the intermediate rolling. Sufficient roller passes shall be made to determine that a "false" break or leveling-off point is not used for the Maximum Roller Pass Density.

4.5 Test Site Density - the uncorrected density reading taken on the compacted pavement after finish rolling is complete at a Test Site for correlation to cores. It is obtained by using the test procedure specified in WAQTC TM 8, without applying a gauge correlation factor. Filler material shall be applied before taking Test Site Density readings.

4.6 Roller Pass - the passing of the roller over an area (roller width) one time.

4.7 Roller Coverage - the rolling of the entire width of the pavement one time, including roller overlap.

4.7.1 Breakdown Rolling constitutes the first roller coverage.

4.7.2 Intermediate Rolling constitutes all rolling after the breakdown rolling and prior to the mix reaching the minimum temperature specified by the contract for such rolling.

4.7.3 Finish Rolling constitutes the roller coverage, after intermediate rolling, required to bring the mix into a smooth, tight, hard surface without the presence of fatigue or cold-brittle cracking.

4.8 Roller Pattern - the number of roller passes necessary to achieve the specified density.

4.9 Stratified Random Sampling of HMA - method used to ensure the specimens for the sample are obtained from throughout the Test Section, and are not concentrated in one portion of the Test Section. All sample locations will be determined by the Engineer using a random sampling system.

5 Procedure

5.1 An Acceptance Test Strip shall be constructed after a uniform asphalt mix is being produced. The Acceptance Test Strip may be constructed using one or more Test Sections. The asphalt binder content of each Test Section must meet all specification requirements.

5.2 The Contractor shall obtain cold feed aggregate samples in accordance with the Specifications. Sampling will be determined by the Engineer using a random sampling system.

5.3 The Contractor shall obtain 3 loose mix samples from each Test Section in accordance with the specifications. Each Test Section will be divided into 3 segments of equal length and a loose mix sample will be obtained randomly from each segment by the contractor for acceptance testing. Exclude the first and last 30 feet of each section when selecting sample locations.

5.4 Each test section will be divided into 5 segments of equal length and test sites for cores and density reading will be obtained randomly from each segment. A minimum of five cores will be required to correlate the density gauges for a test strip. (See WAQTC TM 8 or FOP for AASHTO T 343).

5.5 Standardize the density gauge. Refer to WAQTC TM 8 or FOP for AASHTO T 343.

5.6 The Contractor shall compact each Test Section and record Roller Pass Densities in at least one location within each Test Section but no less than two per Test Strip. When density gauge readings indicate the Maximum Roller Pass Density has been achieved in a Test Section, compaction shall proceed in turn to each of the remaining Test Sections, if applicable, in the Acceptance Test Strip.

5.7 The Contractor shall record the temperature of the pavement following each roller pass to monitor the drop in mix temperature as rolling progresses in at least one location within each Test Section. Temperature readings shall be taken at the mid-point of the depth of pavement being tested.

5.8 Upon completion of all Test Sections in the Acceptance Test Strip, Test Site Densities (Paragraph 4.6) shall be taken for each gauge to be used on the project for Quality Control or Acceptance Testing to determine a correlation factor according to WAQTC TM 8 or FOP for AASHTO T 343. Form ITD-820 will be used by the Contractor and ITD project personnel to record the Test Site Densities for each gauge at each Test Site in each Test Section.

5.8.1 A correlation factor is valid only for the particular gauge, gauge thickness settings, gauge mode setting and at the probe depth used in the correlation procedure. Multiple gauges may be correlated from the same series of cores if done at the same time. (See Note 7, WAQTC TM 8 or FOP for AASHTO T 343)

5.8.2 Additional core correlation factors may be required to adjust for changes in the HMA pavement.

5.8.3 Re-correlation of the gauges is necessary on each lift of pavement.

5.9 After the pavement has cooled sufficiently to avoid deformation during coring, the Contractor shall obtain one core at each Test Site in accordance with WAQTC TM 11. Pavement cores shall meet the criteria under the Correlation section of WAQTC TM 8 or FOP for AASHTO T 343.

5.10 Off-Site Mix Verification. The Contractor, at no cost to the State, may elect to perform off-site mix design testing for contract requirements at a location and time agreed upon by the Engineer. Off-site mix verification must occur within 14 calendar days prior to the anticipated start of production paving.

5.10.1 The off-site mix design verification process will verify aggregate and mix parameters only. All other properties will be determined during a density test strip placed on the prepared surface of the project.

5.10.2 The density test strip shall follow the procedure outlined in Subsection 5.8 to 5.9 and Figure 1a. Break-Over patterns, density gauge correlation factors, density acceptance of the placement, and Contactor's workmanship will be verified during the density test strip. The density test strip shall not exceed 1000 feet in length. Production paving shall not begin until an acceptable density test strip is produced.

5.10.3 Materials from Department controlled sources cannot be used for off-site mix design verification. The off-site test strip shall be accessible to ITD personnel at all times. If other than ITD property, written permission from the property owner shall be given for ITD employees to observe the work.

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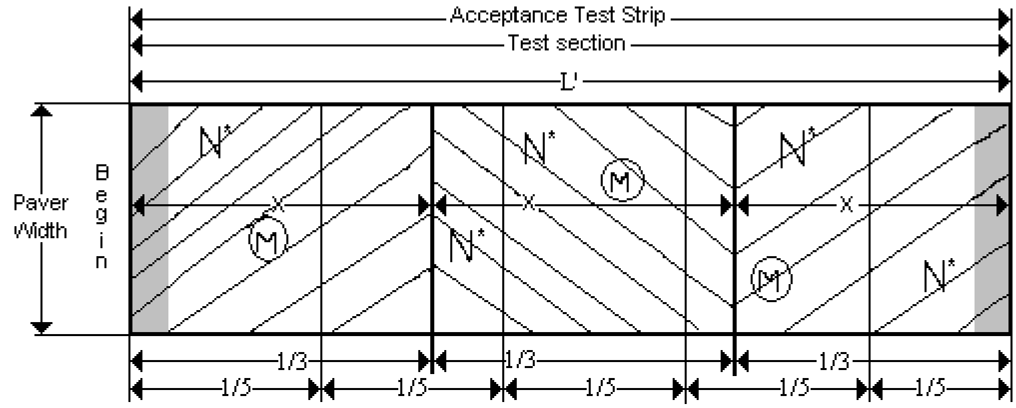
6 Report

6.1 The Contractor shall record the location, the number of roller passes, the corresponding Roller Pass Density reading, and pavement temperature following each roller pass in at least one location in each Test Section. This information shall be recorded on Form ITD-891 (Figure 2).

6.2 The Contractor shall plot Roller Pass Density readings and temperatures vs. roller passes on Form ITD-891 concurrently with the rolling. A copy of each completed ITD-891 shall be furnished to the Engineer upon completion of finish rolling.

6.3 From the cores, the Engineer will determine the density gauge correlation factors for each State gauge and core densities, percent compaction for each Test Section. Laboratory core test results will be provided to the Contractor prior to the start up of production paving for correlation of Contractor gauges. Density gauge correlation data shall be recorded on Form ITD-820 for each gauge.

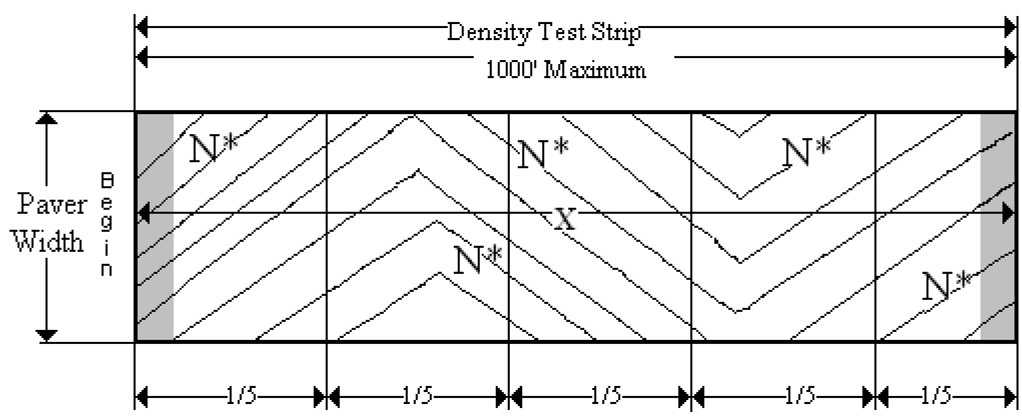
L'	X	N*	*	(M)	
Test Section Length **(see 4.1 & 4.2)**	Number of Roller Passes **(see 4.7)**	Location of Density Gauge reading (test site) **(see 5 Procedure)**	Location of Core **(see 5 Procedure)**	Mix sample location **(see 5 Procedure)**	Avoid taking samples in these areas.



Take mix samples at three stratified random locations. Take one core sample from random test sites selected in each of five stratified segments of the Acceptance Test Strip. The Contractor shall obtain three mix samples and five core samples. Exclude the first and last 30' sections from the generation of the stratified sections.

Figure 1.

X	N*	
Number of roller passes **(See 4.7)**	Location of Core and Density Reading (Test Site) **(See 5.10)**	Avoid taking samples in these locations



The Contractor shall obtain one core sample from random test sites selected in each of five stratified segments of the Density Test Strip. Exclude the first and last 30' sections from the generation of the stratified sections.

Figure 1a.

Figure 2

ITD 0891 (Rev. 3-03)

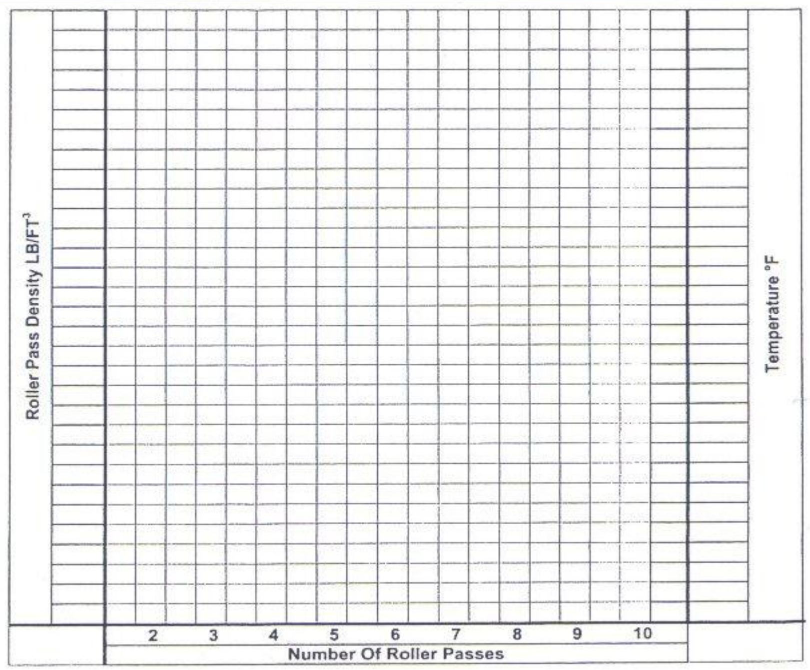
Plant Mix Pavement Test Strip Density Worksheet

Key Number	Project Number and Name	Acceptance Test Strip Number	Date	District Number

Contract Item Number	Contract Item	Aggregate Source Number	Depth	Width	Course

Gage Make	Model	Serial Number	Maximum Theoretical Density ________ from mix design at test section intended asphalt content ________ %

Location		Offset	
Roller Pass	Roller Type Used	Uncorrected Wet Density lb/ft^3	Mix Temp °F
2			
3			
4			
5			
6			
7			
8			
9			
10			



Remarks

Tester's Name	WAQTC No.	ITD Inspector's Name

Distribution: (Original) – Tester (1 copy) – Engineer Page______ of ______

Idaho Standard Method of Test for

Effectiveness of Anti-Strip Agents After Hot Storage In Asphalt Binder

Using Bottle and Sand

Idaho IT-137-04

1 Scope

1.1 This procedure describes the test for effectiveness of anti-strip agents after hot storage in asphalt binder.

1.2 This method is only applicable to asphalt binders that are not liquid at temperatures less than 100°F (38°C).

2 Reference

2.1 Colorado Procedure L-2209.

2.2 Idaho IT-99

3 Reagents and Materials

3.1 Ottawa sand meeting ASTM C 190 grading.

3.2 Distilled water maintained at 77°F (25°C)

3.3 Toluene

3.4 Asphalt binder. (Testing for approval shall be conducted with non-polymerized asphalt)

3.5 Within one (1) laboratory, test all additives using the same grade and source of asphalt binder. When intra-laboratory testing is done for precision determinations, use the same grade and source in all laboratories.

4 Apparatus

4.1 Oven capable of maintaining a temperature of 325°F ± 5°F (163°C ± 3°C).

4.2 Container of sufficient capacity to hold 800 g ± 20 g of asphalt binder plus additive. The diameter of the container shall not be greater than the depth of the asphalt binder plus additive. There shall be a tightly fitting cover or lid with an air hole 1/4 in. (6 mm) in diameter. (metal one (1) quart can dimensions: L= 4.625” W= 2.375” H= 7.25” with opening of 1.75”)

4.3 Paper towels.

4.4 Spatula or other utensil for mixing purposes.

4.5 Glass or plastic bottles, approximately 2 oz. (60 ml) capacity, with top. (Fisherbrand polystyrene containers: 15 dr., I.D. 32 mm X H 64 mm)

4.6 Container having sufficient capacity to allow adequate mixing of 25 g of asphalt binder and additive while adding approximately 4.5 g of toluene. A tinfoil cup of approximately 4 fl. oz. (115 ml) capacity is suitable.

4.7 Balance conforming to AASHTO M 231 Class D.

5 Procedure

5.1 Heat the sample of asphalt binder with care to prevent local overheating until it has become sufficiently fluid to pour. Occasionally stir the sample to aid heat transfer and assure uniformity. The maximum temperature shall not exceed 325°F (163°C) by more than 25°F (14°C). Heat the additive as described above, not exceeding 100°F (38°C) and mix thoroughly.

5.2 Transfer 800 g ± 10 g of asphalt binder into the container (Paragraph 2.2). Add 4 g of anti-stripping agent and mix thoroughly. Place the lid (with air hole) tightly on the container and place in the oven.

5.3 Approval will be based on a concentration of 0.5 % anti-strip by weight.

5.4 After 96 hours, remove the sample, stir, and pour 25 g into a container, as described in Paragraph 2.6. At this time, also perform IT-99 (Color Method) on the aged material. Allow the poured sample to cool to 140°F (60°C). Add 4.5 g of toluene and mix thoroughly.

5.5 **Warning:** Be sure that the asphalt binder has cooled to less than 140°F (60°C) before the toluene is added. The solvent will still vaporize rapidly at this temperature, so this step should be performed where there is good ventilation. No open flames or smoking can be permitted near the mixing operation. The result of adding this solvent is a cutback similar to RC 800.

5.6 Place 20 g ± 1 g of Ottawa sand in the 2 oz. (15 dr.) bottle.

5.7 Add distilled water sufficient to cover the sand to a depth of approximately 1/2 in. (12 mm) above the surface of the sand in the bottle. (16 ml if using the 15 dr. container)

5.8 Add 1 g ± 0.2 g of the prepared cutback material to be tested by dripping it from a spatula onto the surface of the water in the bottle.

5.9 Attach the top on the bottle and shake vigorously for 15 seconds.

5.10 Remove the top and pour off excess water.

5.11 Gently tap wet sand onto a paper towel, spread in a thin layer (not in a cone-shaped mound), and visually inspect the coating of the sand.

6 Report

6.1 If the anti-stripping agent in the concentration tested is effective after heat storage, the wet sand and asphalt mixture described in Paragraph 4.9 will immediately combine into a homogeneous well-coated mixture having a uniform color. In this case, report the test results as "positive." If the bituminous material is deficient in effective anti-stripping agent, the wet sand and asphalt will not mix. Report the test result as "negative."

6.2 Where the sand holds a few globules of asphalt, but the mass is distinctly non-uniform in appearance, report the test as negative.

6.3 Report hours stored at 325°F (163°C) and the results as negative or positive.

6.4 Anti-stripping agents will be approved if, at 0.5 % initial concentration by weight, they give positive results after 96 hours (4 days) at 325°F (163°C) and report positive for IT-99 (Color Method).

Idaho Standard Practice for

Sampling Concrete for Chloride Analysis

Idaho IR-128-95

1 Scope

1.1 This procedure explains methods to be used in sampling concrete for chloride analysis.

1.2 Follow the general guidelines in the Bridge Deck Evaluation and Test Procedure Guideline Manual and AASHTO T 260. Specific and special guidelines are described below.

2 General Sampling Information

2.1 Lay out the test area to be sampled for a minimum of one (1) sample location per 1,000 square feet (100 square meters) and a minimum of three (3) sample locations per deck. Samples should be taken at points of probable high concentration, i.e., curb lines and lower side of super-elevated decks. Samples should not be taken at points where delamination or spalling has occurred since corrosion is obvious at these locations. Spalling or delamination can be located by performing a chain drag evaluation of a bridge deck, which can be valuable if the deck is bare or has a single seal coat. A seal coat of plant mix may give inaccurate information from a chain drag evaluation since the asphalt attenuates the sounds.

2.2 The best way to identify chloride sample depths and locations is to refer to the bridge plans for descriptions of the rebar location and depth, span size, and number of spans. A pachometer can also be used to locate the rebar depths and locations.

3 Sampling Procedures and Guidelines

3.1 For sampling, a rotary hammer is recommended with a 1 inch by 12 inches (25 mm by 300 mm) carbide-tipped bit and various thin wall electrical conduit depth sleeves. Also needed for sampling are a sampling spoon or spatula, 20-dram plastic vials or other sample containers, nylon bristle brushes, paper towels, and 2-Propanol (Isopropyl alcohol). In addition, some means of a "blowout" bulb, a portable air compressor, or other device is needed to clean out the holes after each test depth has been drilled and sampled.

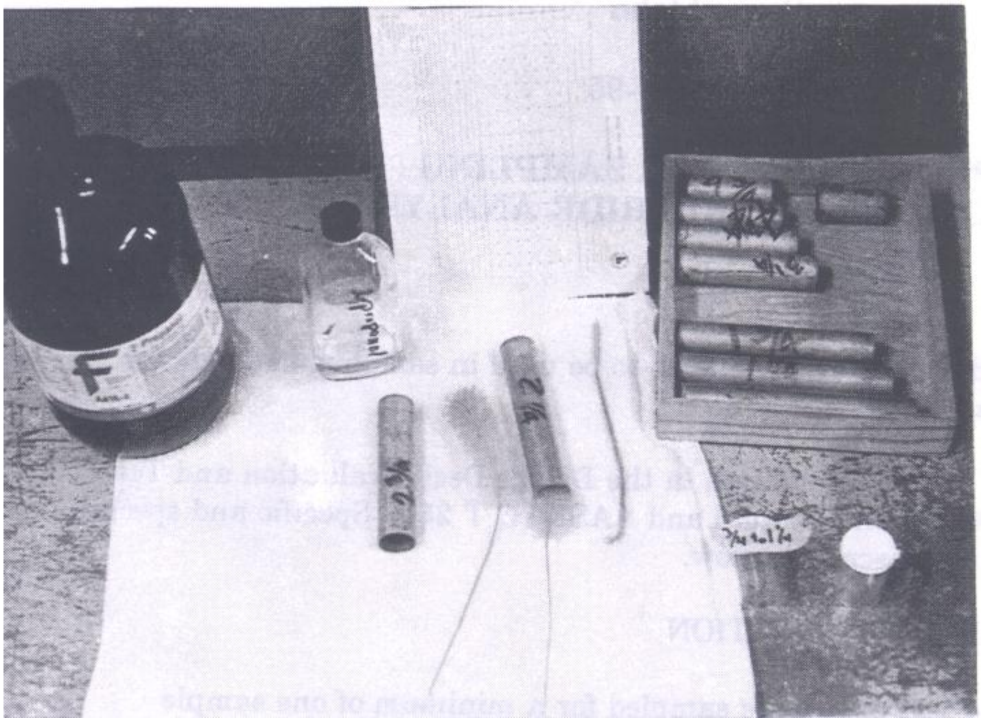
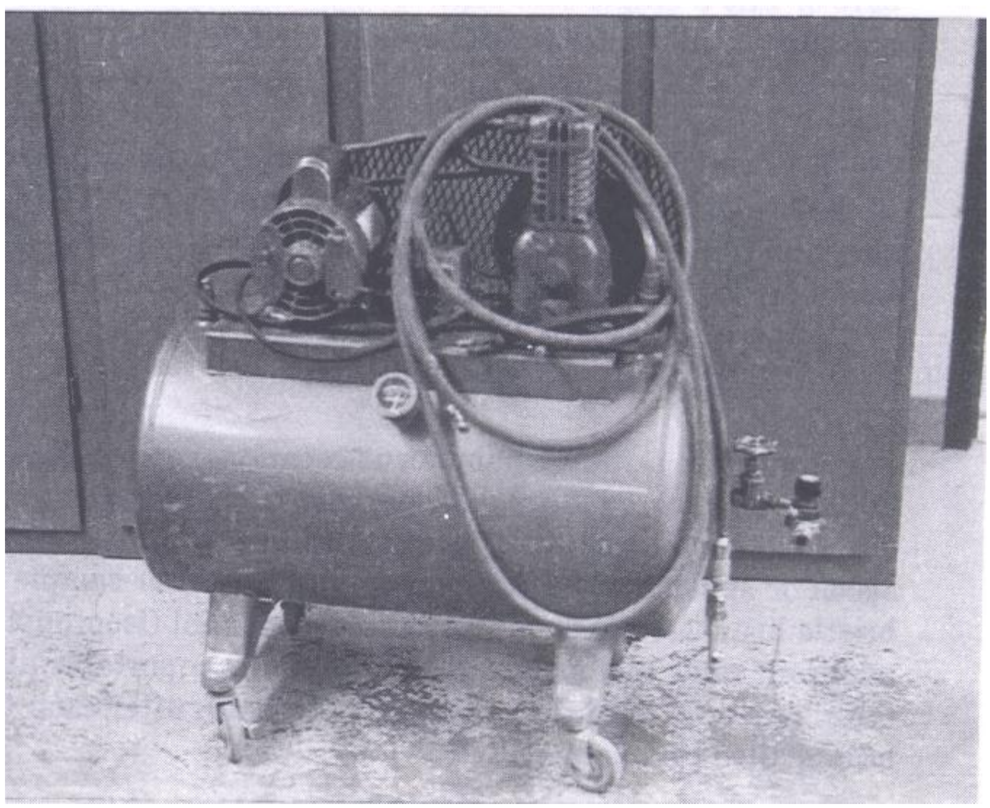


Illustration A

Electrical conduit pipe cut for use as depth sleeves; 2-Propanol and a nylon brush are used to clean between samples.

Illustration B

Portable air compressor for cleaning between samples.



3.2 Samples are usually taken at three (3) separate depths predetermined according to the depth of the rebar in the bridge deck. In addition, a sample taken at or just below the rebar can be informative for severe chloride penetration. The samples are taken at approximately even increments of 1/2 inch (15 mm). See Table 1 below.

Table 1
Nominal Drilling Depths in 1/2 inch Increments
(15 mm)

ENGLISH MEASUREMENT		METRIC MEASUREMENT	
From	To	From	To
1/4 inch	3/4 inch	5 mm	20 mm
3/4 inch	1 1/4 inch	20 mm	35 mm
1 1/4 inch	1 3/4 inch	35 mm	50 mm
1 3/4 inch	2 1/4 inch	50 mm	65 mm
2 1/4 inch	2 3/4 inch	65 mm	80 mm
2 3/4 inch	3 1/4 inch	80 mm	95 mm
3 1/4 inch	3 3/4 inch	95 mm	110 mm

Note: Millimeters (mm) are the metric sample depths and are based upon approximations of the English measurements.

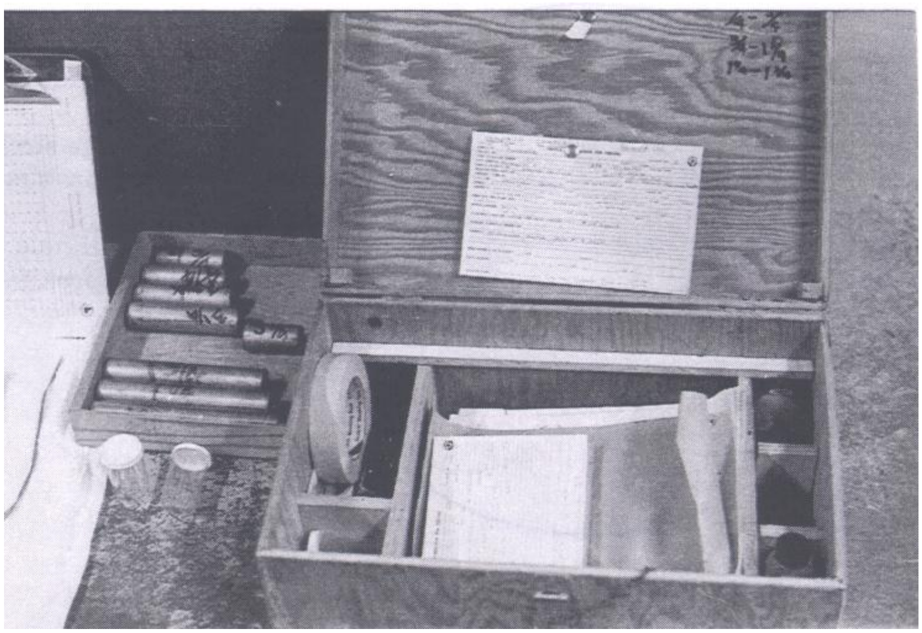


Illustration C

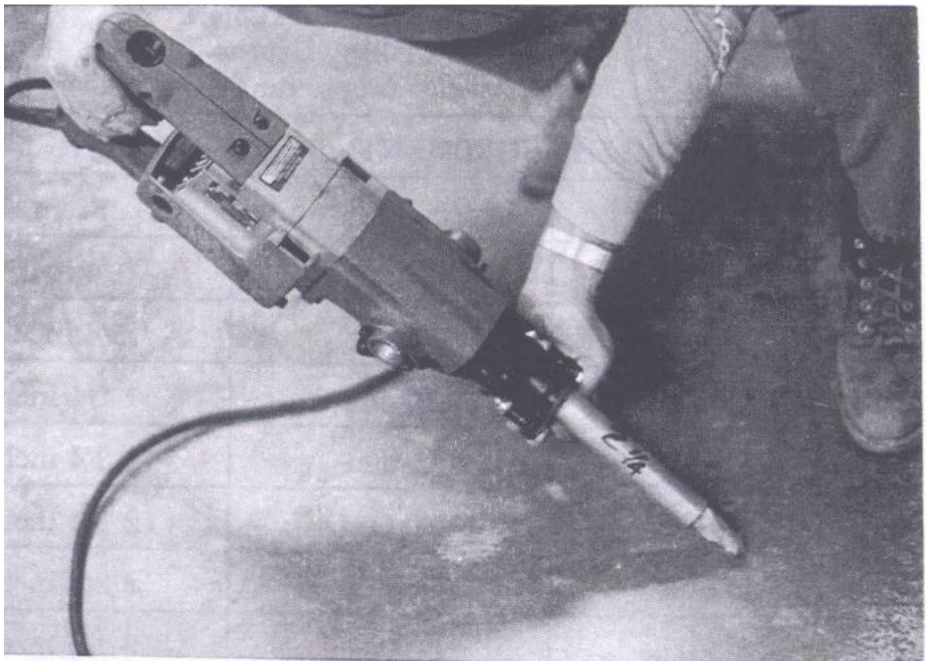
Chloride sampling kit.

3.3 Using the rotary hammer, scar the surface approximately 1/4 inch (6 mm) deep. This assures that the samples will be taken below the surface dirt and other possible sources of erroneously high salt content. Drill three (3) holes within a 6-inch (150 mm) diameter to obtain enough sample from each sampling depth. See Illustration E below.

Illustration D

Rotary hammer for sampling concrete for chloride testing.

Hammer with depth sleeve set 2 1/4 inches (65 mm) sample depth.



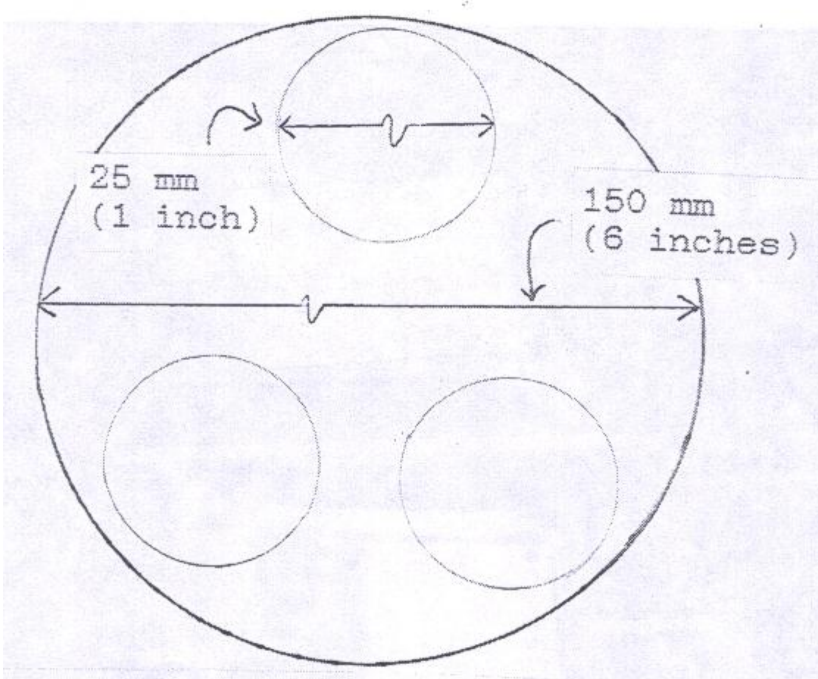


Illustration E

Illustration is not drawn to scale.

Suggested sampling area for one (1) chloride sample location.

Large circle diameter 6 inches (150 mm).

Drill hole diameter 1 inch (25 mm).

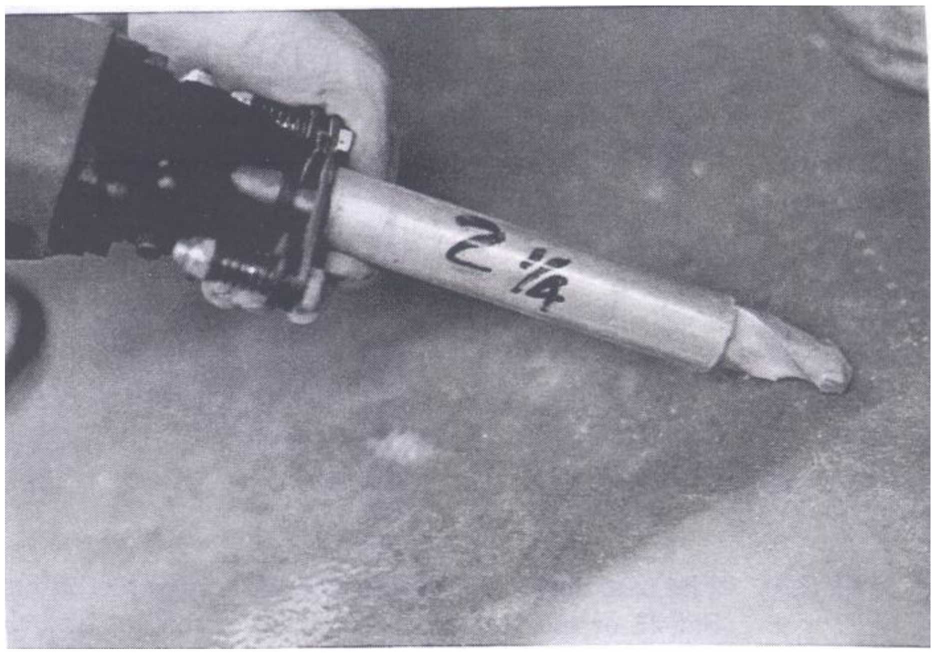
3.4 Blow out the hole and the surrounding area using an air compressor, blowout bulb, or some other means that is suitable. Do not use alcohol to clean out the sample holes. Clean sampling tools: rotary hammer drill bit, depth sleeve, spoon, etc., using a nylon brush, paper towels, and 2-Propanol (Isopropyl alcohol) between samples to assure no contamination between samples. The rotary hammer drill bit and depth sleeves must be completely dry before proceeding with the next sample.

3.5 Place the first depth sleeve on the drill bit and drill in the three (3) established holes with the rotary hammer. See Illustration F below.

Illustration F

Rotary hammer with depth sleeve in place. Ready to drill sample.

Clean drill bit, depth sleeve, and sampling spoon between sample depths with 2-Propanol.



3.6 Drill until the depth sleeve seats itself on the concrete surface. Pull out the drill bit and, using a sampling spoon, carefully gather the pulverized sample out of the three (3) drilled holes. Collect the pulverized sample material carefully and completely. Approximately 15 grams (or a 20-gram vial 3/4 full) is needed for each sample depth. Label the sample container for location and depth. The resulting pulverized concrete represents the first sample depth. See Illustration G below.

3.7 Clean the sampling tools: Drill bit, depth sleeves, spoons, etc., using a nylon brush, paper towels, and 2-Propanol (Isopropyl alcohol) to assure no contamination between samples. Rotary hammer and depth indicators must be completely dry before proceeding with the next sample. Blow out the hole and the surrounding area using an air compressor, blowout bulb, or some other suitable means using air.

3.8 Place the next sleeve guide on the rotary hammer for the next sampling depth. Drill and pulverize the concrete until the depth sleeve again seats itself on the concrete. Continue with steps 3.2.3 through 3.2.5 until all desired sample depths have been drilled and sampled.

3.9 Identify the sampling locations on the ITD-848 Bridge Deck Survey Map or using a created map drawn to scale. Please include with the samples the completed ITD-1044 forms for the samples, identifying specific holes and depths, and a copy of the Bridge Deck Survey Map or created map with information about the areas of delamination. See Appendix A for a copy of form ITD-848 Bridge Deck Survey Map.

Illustration G

An example of a pulverized chloride sample.

3.10 The test hole may be patched with suitable patching material such as Set-45 or mortar (a combination of cement and clean sand) if appropriate.

Appendix A

ITD-848 8-93 M

BRIDGE DECK SURVEY MAP
Resistance/Voltage

PAGE ____ OF ____

DISTRICT ____

BRIDGE NO. ____ KEY NO. ____ PROJECT NO. ____

LOCATION ____ DATE CONSTRUCTED ____ DATE REPORTED ____

NO. OF SPANS ____ SPAN LENGTH ____ DATE OVERLAYED ____ TEST DATA BY ____

DATA UNITS IN: OHMS/VOLTS ____ LANE ____ FEATURE INTERSECTED ____

REMARKS: ____

Idaho Standard Method of Test for

Testing Thickness of Plastic Concrete Pavement

Idaho IT-130-02

1 Scope

1.1 This method is used with plastic concrete pavements to determine concrete pavement thickness while the paving machine is in position and necessary adjustments can be made. This method is used to calculate thickness incentives and disincentives when applicable.

2 Apparatus

2.1 Measuring probe.

2.2 Cleaning cloth.

2.3 Masking tape.

2.4 Tape measure.

2.5 Recording form.

2.6 Bucket.

3 Test Procedure

3.1 All thickness measurements will be taken as efficiently as possible, without disruption of the paving process, from the catwalk located on the backside of the paver.

3.2 The measuring probe shall be placed with its disk flush with the pavement surface. The inner probe shall then be inserted through the full depth of plastic concrete pavement and the thickness shall be measured to the nearest 0.05 in. (millimeter) and recorded on the *ITD-827, Plastic P.C.C. Pavement Thickness Recording Form*.

3.3 Following each measurement, the probe shall be wiped clean.

4 Longitudinal Locations Of Measurements

4.1 The depth measurements shall be taken randomly in the fresh concrete at a rate of one (1) set of probes for each test section.

4.2 Each test section shall be no greater than 0.1 mi. (0.2 km) long.

4.3 The width of a test section shall be a single placement width as defined in Section 5.

4.4 The concrete thickness determined by the set of probes will represent the thickness for the entire area of the test section. The average of the probe measurements shall equal one (1) test (see Section 6).

5 Transverse Locations of Measurement

5.1 For each separate placement, thickness measurements are normally made within 1 ft. (300 mm) of the center of each driving lane and near each edge of each driving lane. When adjacent lanes are placed simultaneously, a single measurement made within 1 ft. (300 mm) of the common lane boundary will represent that edge of both lanes. When a placement includes shoulders, edge measurements may be made either on the lane side or shoulder side of the lane boundary, but should be within 1 ft. (300 mm) of the lane boundary unless special circumstances dictate otherwise (see Section 5.5). When a placement does not include shoulders or when adjacent lanes are not placed simultaneously, make depth measurements at least 1 ft. (300 mm) away from placement edges, but normally not more than 2 ft. (600 mm) away from such edges. Use care to avoid striking and displacing tie bars or dowel bars when making depth measurements.

5.2 Examples of some placement variations and their measurement locations are as follows.

Placement Type	**No. of Meas.**	**Locations of Meas.**
1 lane, no shoulders	3	Within 1 ft. (300 mm) of lane center and between 1 ft. (300 mm) and 2 ft. (600 mm) from placement edges.
1 lane, 1 shoulder	3	Within 1 ft. (300 mm) of lane center, within 1 ft. (300 mm) of lane-shoulder boundary, and between 1 ft. (300 mm) and 2 ft. (600 mm) from the lane edge, which is placed against a form (including slipform) or against existing concrete.
2 lanes, no shoulders	5	Within 1 ft. (300 mm) of lane centers, within 1 ft. (300 mm) of common lane boundary, and between 1 ft. (300 mm) and 2 ft. (600 mm) from placement edges.
2 lanes, 2 shoulders (The example on page 5, Form ITD-827, corresponds to this type of placement on an interstate highway.)	5	Within 1 ft. (300 mm) of lane centers, within 1 ft. (300 mm) of common lane boundary, and within 1 ft. (300 mm) of lane-shoulder boundaries.

- In cases where a tapered or an unusual pavement width is being placed, engineering judgment shall be used to determine where thickness measurements are made. Avoid taking all thickness measurements at locations where grading stakes were positioned.
- After determining where depth measurements shall be taken for any section, the inspector may mark these locations on the paver catwalk with masking tape for convenience.

- When the subgrade base for placement of the concrete pavement is quite irregular in transverse or longitudinal grade, or if other special circumstances exist, this test method may be modified as to measurement locations to assure representative sampling. Record such changes on the ITD-827 and document reasons in the Daily Diary.

6 Analysis of Data

6.1 All thickness measurements taken at each test section location during one (1) pass of the paver shall be averaged. Record the average to the nearest 0.1 in. (2.5 mm).

6.2 AASHTO T 148 (for measuring core lengths) was used as a guideline in establishing the depth increment to be used in recording individual measurements. Also, the roundoff procedure for the average at each thickness measuring station is the same as the procedure used in AASHTO T 148.

6.3 With careful correlation between the thickness measurements and paving machine adjustments, there should be no need for concrete pavement thickness deficiency penalties. Smoothness must be carefully maintained during each adjustment of the paver.

6.4 Care must be exercised on horizontal and vertical curves to avoid excess depths at the low side of horizontal curves and the lowest area in sag-vertical curves. The converse situations of thin pavements at the high side of horizontal and vertical curves must be carefully controlled to achieve the specification thickness.

ITD-827 8-98 W

PLASTIC P.C.C. PAVEMENT THICKNESS RECORDING FORM

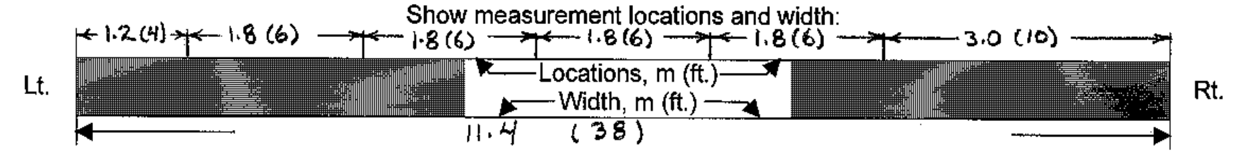
For use with Idaho T-130

Sheet 1 of X

Key No. XXXX Project No. I-84-X(XX)XX

Inspector's Name I.D. Hoe Date 5-20-98

Show measurement locations and width:



Station(s)	Distance from Transverse Edge or Longitudinal Start, m (ft.), and Depth Measurements, mm (in.)						Ave. per Sta., mm (in.)
EB =							=
0+15m =	301	297	295	298	300		= 297.5
0+50 =	306	302	310	315	309		= 307.5
0+90 =	307	310	312	314	308		= 310.0
1+50 =	311	309	304	301	307		= 307.5
3+00 =	309	311	313	310	314		= 312.5
4+50 =	306	310	308	305	307		= 307.5
6+00 =	308	309	312	305	310		= 310.0
7+50 =	312	315	310	313	309		= 312.5
=							=
=							=
— =	—	—	—	—	—	—	= —
=							=
=							=
EB =							=
0+50 ft =	11.85	11.70	11.50	11.75	11.80		= 11.7
1+50 =	12.05	11.90	12.20	12.40	12.15		= 12.1
3+00 =	12.10	12.20	12.30	12.35	12.15		= 12.2
5+00 =	12.25	12.15	11.95	11.85	12.10		= 12.1
10+00 =	12.15	12.25	12.30	12.20	12.35		= 12.2
15+00 =	12.05	12.20	12.15	12.00	12.10		= 12.1
20+00 =	12.15	12.15	12.30	12.00	12.20		= 12.2
25+00 =	12.30	12.40	12.20	12.30	12.15		= 12.3
=							=
=							=
=							=
=							=
=							=

Idaho Standard Method of Test for

Total Chloride Content of Hardened Concrete by Gran Plot Method

Idaho IT-131-90

1 Scope

1.1 This method describes the laboratory analysis of chloride ion in hardened concrete.

2 Summary of Method

2.1 Test according to AASHTO T 260 "Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials" using Method II: Gran Plot method for analysis.

2.2 A standard solution containing 1 milliliter of known concentration of chloride ion (1000 ppm) and a blank of distilled water are also tested for percent recovery and to obtain a high degree of precision.

2.3 Equipment and Reagents for Chemical Testing.

2.3.1 Chloride ion or silver/sulfide ion selective electrode and manufacturer-recommended filling solutions. Suggested electrodes are the Orion 96-17 or Orion 94-6 used with Orion 90-02 or equivalent.

2.3.2 A millivoltmeter compatible with the ion electrode.

Suggested millivoltmeter is the Orion Model 901A Specific Ion meter or equivalent.

2.3.3 Magnetic stirrer and teflon stirring bars.

2.3.4 A 25 ml buret with 0.1 ml graduations.

2.3.5 Balance sensitive to 0.0001 gram with minimum capacity of 100 grams.

2.3.6 Balance sensitive to 0.1 grams with minimum capacity of 1 Kg.

2.3.7 Hot plate, 250°C to 400°C heating surface temperature.

2.3.8 Glassware 150 and 250 ml beakers, filter funnels, stirring rods, watch glasses, dropper, Guth wash bottles.

2.3.9 Sieve, U.S. Standard No. 50 (0.300 mm).

2.3.10 Whatman No. 40 and No. 41 filter papers (or equivalent).

If equivalent filter papers are used, they should be checked to confirm they do not contain chloride that will contaminate the sample.

2.3.11 Concentrated HNO_3 (specific gravity 1.42).

2.3.12 Sodium chloride, NaCl, reagent grade (primary standard).

2.3.13 Standard 0.01N_NaCl solution. Dry reagent grade NaCl in an oven at 105°C. Cool, in a dessicator, weigh out approximately 0.5844 to the nearest 0.0001 gram, dissolve in distilled H_20, and transfer to a 1 liter volumetric flask. Make up to the mark with distilled H_20 and mix. Calculate the exact normality as follows:

$$N\_NaCl = (0.0100)\frac{(Wt\ actual)}{0.5844}$$

Wt actual = actual weight of NaCl

N_NaCl = normality of NaCl solution

2.3.14 Standard 0.01N_$AgNO_3$. Weigh 1.7 grams of reagent $AgNO_3$, transfer to 1000 ml volumetric flask, dissolve in distilled water. QS to volume and mix thoroughly. Standardize by the titration method given in Section 2.5.2.

2.3.15 Distilled/Demineralized Water.

Deionized water may be used in place of distilled water for samples where extreme precision and accuracy are not demanded.

2.3.16 Methyl orange indicator.

2.3.17 Ethanol, denatured or methanol, technical.

2.4 AASHTO T 260 Procedure and Modifications.

2.4.1 Weigh to the nearest milligram a 3 gram powdered sample representative of the material under test.

Some users dry the sample to constant weight in a 105°C oven and determine the dry sample weight prior to analysis. This optional procedure provides a constant base for comparison of all results by eliminating moisture content as a variable. It is generally believed that drying is only necessary when very high accuracy is desired.

2.4.2 Transfer the sample quantitatively to a 150 ml beaker, add 10 ml of distilled H_2O swirling to bring the powder into suspension. Add 3 ml of conc. HNO_3 with continued swirling until the material is completely decomposed. Break up any lumps with a stirring rod and dilute with hot H_20 to 50 ml. Stir thoroughly to ensure complete sample digestion. Add five (5) drops of methyl orange indicator and stir. If yellow to yellow-orange color appears, solution is not sufficiently acidic. Add additional concentrated HNO_3 drop-wise with continuous stirring until a faint pink or red color persists in the solution. Cover with a watch glass. Heat the acid solution or slurry to boiling on a hot plate at medium heat (250°C to 400°C) and boil for about 1 minute. Remove from the hot plate, filter through double filter paper (Whatman No. 41 over No. 40 filter paper or equivalent), into a 250 ml beaker which has been preweighed with the tare weight recorded.

2.4.2.1 A blank and a known chloride concentration standard are run every 10 samples for internal Quality Assurance. The blank and known are made using only reagents and distilled H_20. The known contains 10 ml of 100 ppm chloride (Cl^-) standard.

Due to the presence of relatively insoluble materials in the sample, the solution generally will have a strong gray color, making the detection of indicator color difficult at times. Running of several trial samples is suggested to give the analyst practice in detecting the indicator color.

A sample prepared to 100 percent passing No. 50 sieve (0.300 mm) should generally allow determination of any expected chloride level with adequate precision and accuracy. Samples containing highly siliceous aggregates may require finer grinding to minimize solution bumping during boiling. This may also be the case when the concrete contains modifiers such as latex or polymer.

2.4.3 Transfer solution and wash the filter papers thoroughly with hot distilled H_20 3 to 5 times. After washing is complete, lift the filter paper carefully from the funnel and wash to outside surface of the paper with hot distilled H_20; then wash the tip of the funnel. The final volume of the filtered solution should be less than 100 ml. Cover with a watch glass and allow to cool to room temperature in the HC1 fume-free atmosphere. Remove the watch glass and place the beaker on the balance. Add sufficient distilled water to bring the weight of solution to 100 grams $\pm$ l grams. This eliminates the need for the volume corrections.

Weigh the filtrate solution and beaker without the watch glass and record the weight.

2.5 Method II Gran Plot Method with Cl^- selective ion electrode.

2.5.1 Setup and Calibration.

Polish the chloride electrode according to manufacturer's recommendations and attach to the Orion 901 Ionanalyzer. Fill the double junction reference electrode with inner and outer solutions according to manufacturer's instructions and attach to Ionanalyzer. Perform slope calibration as follows.

Prepare 150 ml beaker with 87 ml distilled water, 3 ml conc. HNO_3, and 10 ml 100 PPM-Cl^- standard solution for calibration standard. Set instrument to MV and put electrodes in calibration solution, wait for a steady reading. Press "set conc." button on instrument and leave on. Add 10 ml 1000 PPM-Cl^- standard solution, wait for a steady reading. Final reading on digital readout is the daily slope along with standard value of 10.00. Slope reading is read as negative number. Record slope setting in instrument notebook and on chloride sample worksheet.

2.5.2 Calibration of $AgNO_3$.

Rinse electrodes with distilled water and dry. Fill a 25 ml buret with $AgNO_3$ solution. Prepare a 250 ml beaker with 10 ml 0.01N_NaCl solution, 3 ml conc. HNO_3 and 87 ml distilled water, and stir bar. Place sample on magnetic stirplate with electrode in solution and while stirring record initial MV reading. Add $AgNO_3$ until MV reading is between 300 and 310 MV, record reading. Continue to titrate in 0.50 ml increments recording volume added and MV reading for each increment for at least five (5) increments. Calculate the exact normality as follows:

$$N\_AgNO_3 = \frac{(V\_NaCl)(N\_NaCl)}{V\_AgNO_3}$$

N_$AgNO_3$ = normality of $AgNO_3$ Solution

V_NaCl = volume (ml) of NaCl Solution

N_NaCl = normality of NaCl Solution

V_AgNO_3 = volume (ml) of $AgNO_3$ Solution (Use blank and volume corrected end point) Follow steps 2.6.1 through 2.6.3 for correct calculation of V $AgNO_3$.

2.6 Chloride Sample Instrumental Analysis.

After calibration of Ionanalyzer and $AgNO_3$ solution prepare sample filtrate for MV readings. Weigh filtrate, record weight and add distilled water to bring volume to 100 ± 1 grams. Place rinsed and dry electrodes in sample solution. Read and record millivolt reading for sample before $AgNO_3$ is added. Using the 25 ml buret, titrate the sample between 300-310 MV with standard 0.01 N_$AgNO_3$ solution to the nearest 0.50 ml increment. Record the volume added and the millivoltmeter reading on the chloride work sheet.

Continue to titrate in 0.50 ml increments, recording volume added and the millivoltmeter reading for each increment. Add and record the data for at least five (5) increments on the chloride work sheet.

2.6.1 Gran Plot Method Calculations.

Calculate corrected values for each of the volumes recorded in Section 2.6 by the equation:

If filtrate weight is > 101 grams then:

$$V\_Correct = \frac{V\_record}{Wt \div 100}$$

Where:

Wt = original solution weight in grams.

V_record = volumes recorded in ml.

If filtrate weight is 100 $\pm$ 1 grams, then V_correct = V_record.

Proceed to 2.6.2.

2.6.2 Titration Volume Plotting & Calculation.

If any of the V_correct values are greater than 10, see Section 2.6.3. If less than 10, plot these corrected values versus the corresponding millivolt readings on Orion Gran Plot Paper (10 percent volume corrected type with each major vertical scale division equal to 5 millivolts) or equivalent. Draw the best straight line through the points and read the endpoint at the intersection of the line with the horizontal axis of the graph. Calculate the actual endpoint by the equation:

$$E_a = \left(E_g\right)\left(\frac{\mathrm{Wt}}{100}\right)$$

Where:

E_a = actual endpoint

E_g = endpoint determined from graph in ml. The reagent blank endpoint ml will be subtracted from all sample and standard endpoints before PPM-Cl^- or final lb. Cl^- /c.y. concrete calculations.

Wt = weight of solution in grams.

2.6.3 Volume Correction.

When the V_correct volumes determined during titration are greater than 10, discard the values and follow the following procedure.

Choose a constant which, when subtracted from all V_record volumes, yields values less than 10 ml.

Note 1: This constant, designated as X in the formulas below, is normally assigned an even value such as 5, 10, 15, 20, etc.

Calculate a revised solution weight Wt_r as:

$Wt_r = Wt + X$

Where:

Wt = original solution weight in grams

X = the constant

Then calculate corrected volumes for each recorded volume as:

$$V\_Correct = \frac{V\_record - X}{Wt_r \div 100}$$

Plot these values and determine the graph endpoint E_g, as described in Section 2.6.2.

The actual endpoint E_a is then:

$$E_a = (E_g)\left(\frac{Wt_r}{100}\right) + X$$

Where:

E_a = actual endpoint in ml.

E_g = endpoint from graph in ml with blank subtracted.

Wt_r = revised solution weight in grams.

X = the constant chosen above.

Calculate the chloride content using the formula given below.

Calculation or ppm recovery of Cl^- standard:

$$(N\_AgNO_3)\left(\frac{(mw\,Cl^-)}{35.453}\right)(1000)(E_a) = ppm\,Cl^-$$

Percent Cl^- is calculated as follows:

$$\text{Percent } Cl^- = \left(\frac{3.5453}{Wt_c}\right)(E_a)(N)$$

Where:

E_a = actual endpoint, in ml.

N = normality of $AgNO_3$ solution.

Wt_c = concrete sample weight in grams.

The percent chloride may be converted to pounds of Cl^- per cubic yard of concrete as follows:

$$\frac{lb.Cl^-}{yd^3} = (\text{percent } Cl^-)\left(\frac{Wt_U}{100}\right)$$

Where:

Wt_U = unit weight of concrete per cubic yard.

Note 2: A unit weight of 3,915 lb./yd^3 is often assumed for normal structural weight concrete when the actual unit weight is unknown.

Results are reported as lb. Cl^-/yd^3 concrete as follows for 3.0000 gram sample:

$$\frac{lb.Cl^-}{yd^3} = \left(\frac{3.5453}{3.0000}\right)(N)(E_a)\left(\frac{3{,}915}{100}\right)$$

Which reduces to:

$$\text{lb. } Cl^-/yd^3 = \underset{\text{(factor)}}{(46.27)}\,(N)\,(E_a)$$

Where:

N = normality of $AgNO_3$

E_a = actual endpoint in ml $(E_g)\left(\frac{Wt}{100}\right) - blank$

Idaho specifications for Cl^- value = 2 lb. Cl^-/yd^3 max.

Precision and Accuracy Data – As documented in AASHTO T 260.

Idaho Standard Method of Test for

Determination of the Rate of Evaporation of Surface Moisture From Concrete

Idaho IT-133-07

1 Scope

1.1 This method shall be used to determine the rate of evaporation of surface moisture from concrete surfaces.

2 Reference

2.1 ACI Manual of Concrete Practice, Section 305R.

3 Apparatus

3.1 Thermometer, 0^{o}F to 180^{o}F (-20^{o}C to 80^{o}C), Dial Type.

3.2 Wind meter.

3.3 Hygrometer, stationary mason's form.

4 Test Procedure

4.1 Determine the ambient air temperature by reading the dry-bulb on the hygrometer. For example, 80^{o}F (27^{o}C).

4.2 Determine the relative humidity by reading both the dry-bulb and the wet-bulb on the hygrometer. Then, using the Relative Humidity Table (Figure 1E or 1M), locate in the margin the reading corresponding to the dry-bulb indication. Locate in the other margin the reading corresponding to the wet-bulb indication. The relative humidity is read at the intersection of these two (2) columns. For example, given dry-bulb temperature 80^{o}F (27^{o}C) and wet-bulb temperature 67^{o}F (19.5^{o}C), the relative humidity is 50 percent.

4.3 Determine the concrete temperature by placing the dial thermometer into a sample of the concrete. For example, 88^{o}F (31^{o}C).

4.4 Determine the wind velocity by using the wind meter. Face the wind. Hold the meter in front of you in a vertical position with the scale side facing you. Do not block the bottom holes. The height of the ball indicates the wind velocity.

For winds in excess of 10 mph (16 km/hr), use the high scale. For high scale, cover the hole at the extreme top of the wind meter with a finger. For example, 12 mph (19 km/hr).

4.5 Determine the evaporation rate by using the chart (Figure 2). Enter the chart at air temperature, degrees F (C). For example, 80^{o}F (27^{o}C). Move up to relative humidity. For example, 50 percent. Move right to the concrete temperature. For example, 88^{o}F (31^{o}C). Move down to wind velocity. For example, 12 mph (19 km/hr). Move left and read approximate rate of evaporation. For example, 0.25 lb/sq ft/hr (1.25 kg/m^2/hr).

5 Precautions

5.1 Read the instructions furnished with both the hygrometer and wind meter for accurate operation of both instruments.

5.2 In determining the evaporation rate of surface moisture, keep in mind that later in the day the air temperature, relative humidity, and wind velocity may change drastically, causing a considerable increase in the evaporation rate.

6 Rate of Evaporation

6.1 The rate of evaporation is influenced by the relative humidity, concrete and air temperature, and wind velocity. Even relatively small changes in these atmospheric conditions may have a pronounced effect on the rate of evaporation, especially if they occur simultaneously.

For example, when the relative humidity changes from 90 to 50 percent, the rate of evaporation is increased five (5) times. If further reduced to ten percent (10%), evaporation is increased nine (9) times.

6.2 When both concrete and air temperature increase from 50°F to 70°F (10°C to 21°C), evaporation is doubled. If further increased to 90°F (32°C), evaporation is increased four (4) times.

6.3 With an air temperature of 40°F (4°C), the rate of evaporation is tripled when the concrete temperature is raised from 60°F to 80°F (16°C to 27°C).

6.4 The rate of evaporation is four (4) times greater when the wind velocity increases from 0 to 10 mph (0 to 16 km/hr) and is nine (9) times greater when the wind velocity further increases to 25 mph (40 km/hr).

6.5 It is apparent, then, that the rate of evaporation is highest when the relative humidity is low, when concrete and air temperatures are high, when the concrete temperature is higher than the air temperature and when the wind is blowing over the concrete surface. The combination of hot, dry weather and high winds often prevailing during summer months removes moisture from the surface faster than it can be replaced by normal bleeding; but even in cold weather rapid drying is possible if the temperature of concrete, when placed, is high compared to the air temperature.

Figure 1E—Relative Humidity Table (English)

DRY BULB TEMPERATURE °F

WET BULB TEMPERATURE °F	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
36	3																												
38	12	7	1																										
40	22	16	10	5																									
42	32	25	18	13	8	4																							
44	42	34	27	21	16	11	7	3																					
46	53	44	37	30	24	18	14	10	6	3																			
48	64	55	46	39	32	26	21	16	12	9	5	3																	
50	76	65	56	48	41	34	29	23	19	15	11	8	5	3															
52	88	76	66	58	50	43	36	31	25	21	17	13	10	7	4	3	1												
54	100	88	77	68	59	51	44	38	33	28	23	19	16	12	10	7	5	3	1										
56		100	88	78	69	60	53	46	40	34	29	25	21	18	14	12	9	7	5	3	1								
58			100	89	79	70	61	54	48	42	36	31	27	23	20	16	14	11	9	7	5	3	2						
60				100	89	79	71	62	55	49	43	38	33	29	25	21	18	15	13	11	9	7	5	3	2				
62					100	90	80	71	64	57	50	44	39	35	30	26	23	20	17	15	12	10	8	7	5	3	2	1	
64						100	90	80	72	65	58	51	46	41	36	32	28	25	22	19	16	14	12	10	8	7	5	4	2
66							100	90	81	73	65	59	53	47	42	37	33	30	26	23	20	18	15	13	11	10	8	7	5
68								100	90	82	74	66	60	54	48	43	39	35	31	28	24	22	19	17	15	13	11	10	8
70									100	91	82	74	67	61	55	49	44	40	36	32	29	26	23	21	18	16	14	12	11
72										100	91	82	75	68	61	56	50	46	41	37	33	30	27	24	22	20	17	16	14
74											100	91	83	75	69	62	57	51	47	42	38	35	32	28	26	23	21	19	17
76												100	91	83	76	69	63	57	52	48	43	39	36	33	30	27	24	22	20
78													100	91	84	76	70	64	58	53	49	44	40	37	34	31	28	25	23
80														100	92	84	77	70	65	59	54	50	45	41	38	35	32	29	26
82															100	92	84	77	71	65	60	55	50	46	42	39	36	33	30
84																100	92	85	78	72	66	61	55	51	47	43	40	37	34
86																	100	92	85	78	72	66	61	56	52	48	44	41	38
88																		100	92	85	79	73	67	62	57	53	49	45	42
90																			100	92	85	79	73	68	62	58	53	49	46
92																				100	93	86	79	73	68	63	58	54	50
94																					100	93	86	80	74	69	64	59	55
96																						100	93	86	80	74	69	64	60
98																							100	93	86	80	75	70	65
100																								100	93	87	81	75	70
102																									100	93	87	81	75
104																										100	93	87	81
106																											100	93	87
108																												100	93
110																													100

Interpolate tables for other temperatures

DRY BULB TEMPERATURE °F

Figure 1M—Relative Humidity Table (Metric)

DRY BULB TEMPERATURE °C

WET BULB TEMPERATURE °C	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0
-2.5	3																								
-2.0	9	5	1																						
-1.5	14	10	7	3																					
-1.0	21	16	12	8	5	2																			
-0.5	27	22	18	14	10	7	4	1																	
0.0	33	28	24	20	16	12	9	5	2																
0.5	39	34	30	25	21	17	14	10	7	4	1														
1.0	46	40	36	31	27	23	19	15	12	9	6	3	1												
1.5	52	47	42	37	32	28	24	20	17	14	11	8	5	2											
2.0	59	53	48	43	38	34	29	26	22	18	15	12	9	7	4	2									
2.5	65	59	54	49	44	39	35	31	27	23	20	17	14	11	8	6	3	1							
3.0	72	66	60	55	50	45	40	36	32	28	25	21	18	15	12	10	7	5	3	1					
3.5	79	73	67	61	56	51	46	41	37	33	30	26	23	20	17	14	11	9	6	4	2				
4.0	86	79	73	67	62	57	52	47	43	38	34	31	27	24	21	18	15	13	10	8	6	4	2		
4.5	93	86	80	74	68	62	57	52	48	44	39	36	32	29	25	22	19	17	14	12	9	7	5	3	2
5.0	100	93	86	80	74	68	63	58	53	49	45	41	37	33	30	27	23	21	18	15	13	11	9	7	5
5.5		100	93	87	80	75	69	64	59	54	50	46	42	38	34	31	28	25	22	19	17	14	12	10	8
6.0			100	93	87	81	75	70	64	60	55	51	46	43	39	35	32	29	26	23	20	18	16	13	11
6.5				100	93	87	81	75	70	65	60	56	51	47	43	40	36	33	30	27	24	22	19	17	15
7.0					100	93	87	81	76	71	66	61	56	52	48	44	41	37	34	31	28	25	23	20	18
7.5						100	94	88	82	76	71	66	62	57	53	49	45	42	38	35	32	29	27	24	22
8.0							100	94	88	82	77	72	67	62	58	54	50	46	43	39	36	33	30	28	25
8.5								100	94	88	82	77	72	67	63	59	55	51	47	44	40	37	34	31	29
9.0									100	94	88	83	78	73	68	63	59	55	51	48	44	41	38	35	32
9.5										100	94	88	83	78	73	68	64	60	56	52	49	45	42	39	36
10.0											100	94	89	83	78	73	69	65	60	57	53	49	46	43	40
10.5												100	94	89	84	79	74	69	65	61	57	54	50	47	44
11.0													100	94	89	84	79	74	70	66	62	58	54	51	48
11.5														100	94	89	84	79	75	70	66	62	58	55	51
12.0															100	95	89	84	80	75	71	67	63	59	56
12.5																100	95	89	85	80	75	71	67	63	60
13.0																	100	95	90	85	80	76	72	68	64
13.5																		100	95	90	85	80	76	72	68
14.0																			100	95	90	85	81	76	72
14.5																				100	95	90	85	81	77
15.0																					100	95	90	86	81
15.5																						100	95	90	86
16.0																							100	95	90
16.5																								100	95
17.0																									100
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29.5																									
30.0																									

DRY BULB TEMPERATURE °C

Sheet 1 of 4

Figure 1M (Contd)

DRY BULB TEMPERATURE °C

WET BULB TEMPERATURE °C	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5	26.0	26.5	27.0	27.5	28.0	28.5	29.0	29.5	30.0	WET BULB TEMPERATURE °C
-2.5																											-2.5
-2.0																											-2.0
-1.5																											-1.5
-1.0																											-1.0
-0.5																											-0.5
0.0																											0.0
0.5																											0.5
1.0																											1.0
1.5																											1.5
2.0																											2.0
2.5																											2.5
3.0																											3.0
3.5																											3.5
4.0																											4.0
4.5																											4.5
5.0	3	1																									5.0
5.5	6	4	3	1																							5.5
6.0	9	7	6	4	2	1																					6.0
6.5	13	11	9	7	5	4	2	1																			6.5
7.0	16	14	12	10	8	7	5	4	2	1																	7.0
7.5	19	17	15	13	11	10	8	6	5	3	2	1															7.5
8.0	23	20	18	16	14	12	11	9	8	6	5	3	2	1													8.0
8.5	26	24	21	19	17	15	14	12	10	9	7	6	5	3	2												8.5
9.0	30	27	25	23	20	18	17	15	13	11	10	8	7	6	4	3	2	1									9.0
9.5	33	31	28	26	24	21	19	18	16	14	12	11	9	8	7	6	4	3	2	1							9.5
10.0	37	34	32	29	27	25	23	21	19	17	15	14	12	11	9	8	7	5	4	3	2	1	1				10.0
10.5	41	38	35	33	30	28	26	23	22	20	18	16	15	13	12	10	9	8	7	5	4	3	2	2	1		10.5
11.0	44	41	39	36	33	31	29	27	24	22	21	19	17	16	14	13	11	10	9	8	6	5	4	3	3	2	11.0
11.5	48	45	42	39	37	34	32	30	27	25	23	22	20	18	17	15	14	12	11	10	8	7	6	5	4	4	11.5
12.0	52	49	46	43	40	38	35	33	30	28	26	24	22	21	19	17	16	15	13	12	11	9	8	7	6	5	12.0
12.5	56	53	50	47	44	41	38	36	34	31	29	27	25	23	22	20	18	17	15	14	13	12	10	9	8	7	12.5
13.0	60	57	53	50	47	44	42	39	37	34	32	30	28	26	24	23	21	19	18	16	15	14	12	11	10	9	13.0
13.5	64	61	57	54	51	48	45	42	40	37	35	33	31	29	27	25	23	22	20	19	17	16	15	13	12	11	13.5
14.0	68	65	61	58	55	52	49	46	43	41	38	36	34	32	30	28	26	24	23	21	19	18	17	15	14	13	14.0
14.5	73	69	65	62	58	55	52	49	47	44	41	39	37	34	32	30	29	27	25	23	22	20	19	18	16	15	14.5
15.0	77	73	69	66	62	59	56	53	50	47	45	42	40	37	35	33	31	29	28	26	24	23	21	20	18	17	15.0
15.5	81	77	73	70	66	63	59	56	53	50	48	45	43	40	38	36	34	32	30	28	27	25	23	22	20	19	15.5
16.0	86	82	78	74	70	67	63	60	57	54	51	48	46	43	41	39	37	35	33	31	29	27	26	24	23	21	16.0
16.5	91	86	82	78	74	70	67	64	60	57	54	52	49	46	44	42	39	37	35	33	31	30	28	26	25	23	16.5
17.0	95	91	86	82	78	74	71	67	64	61	58	55	52	50	47	45	42	40	38	36	34	32	30	29	27	26	17.0
17.5	100	95	91	87	82	79	75	71	68	64	61	58	55	53	50	48	45	43	41	39	37	35	33	31	29	28	17.5
18.0		100	95	91	87	83	79	75	72	68	65	62	59	56	53	51	48	46	44	41	39	37	35	34	32	30	18.0
18.5			100	95	91	87	83	79	75	72	69	65	62	59	56	54	51	49	46	44	42	40	38	36	34	32	18.5
19.0				100	95	91	87	83	79	76	72	69	66	63	60	57	54	52	49	47	45	42	40	38	37	35	19.0
19.5					100	96	91	87	83	80	76	73	69	66	63	60	57	55	52	50	47	45	43	41	39	37	19.5
20.0						100	96	91	87	83	80	76	73	70	66	63	61	58	55	53	50	48	46	44	42	40	20.0
20.5							100	96	91	87	84	80	76	73	70	67	64	61	58	56	53	51	48	46	44	42	20.5
21.0								100	96	92	88	84	80	77	73	70	67	64	61	59	56	54	51	49	47	45	21.0
21.5									100	96	92	88	84	80	77	74	71	67	65	62	59	57	54	52	49	47	21.5
22.0										100	96	92	88	84	81	77	74	71	68	65	62	59	57	55	52	50	22.0
22.5											100	96	92	88	84	81	77	74	71	68	65	63	60	57	55	53	22.5
23.0												100	96	92	88	85	81	78	74	71	68	66	63	60	58	55	23.0
23.5													100	96	92	88	85	81	78	75	72	69	66	63	61	58	23.5
24.0														100	96	92	88	85	81	78	75	72	69	66	64	61	24.0
24.5															100	96	92	89	85	82	78	75	72	69	67	64	24.5
25.0																100	96	92	89	85	82	79	75	72	70	67	25.0
25.5																	100	96	92	89	85	82	79	76	73	70	25.5
26.0																		100	96	92	89	85	82	79	76	73	26.0
26.5																			100	96	93	89	86	82	79	76	26.5
27.0																				100	96	93	89	86	82	79	27.0
27.5																					100	96	93	89	86	83	27.5
28.0																						100	96	93	89	86	28.0
28.5																							100	96	93	89	28.5
29.0																								100	96	93	29.0
29.5																									100	96	29.5
30.0																										100	30.0
	17.5	18.0	18.5	19.0	19.5	20.0	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5	26.0	26.5	27.0	27.5	28.0	28.5	29.0	29.5	30.0	

DRY BULB TEMPERATURE °C

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DRY BULB TEMPERATURE °C

WET BULB TEMPERATURE °C

	30.5	31.0	31.5	32.0	32.5	33.0	33.5	34.0	34.5	35.0	35.5	36.0	36.5	37.0	37.5	38.0	38.5	39.0	39.5	40.0	40.5	41.0	41.5
11.0	1																						
11.5	3	2	1																				
12.0	4	4	3	2	1	1																	
12.5	6	5	4	4	3	2	1	1															
13.0	8	7	6	5	5	4	3	2	2	1													
13.5	10	9	8	7	6	5	5	4	3	3	2	1	1										
14.0	12	11	10	9	8	7	6	5	5	4	3	3	2	2	1								
14.5	14	13	12	11	10	9	8	7	6	6	5	4	3	3	2	2	1	1					
15.0	16	15	14	12	11	10	10	9	8	7	6	6	5	4	4	3	2	2	1	1			
15.5	18	17	15	14	13	12	11	10	9	9	8	7	6	6	5	4	4	3	3	2	2	1	1
16.0	20	19	17	16	15	14	13	12	11	10	9	9	8	7	6	6	5	4	4	3	3	2	2
16.5	22	21	19	18	17	16	15	14	13	12	11	10	9	9	8	7	6	6	5	5	4	3	3
17.0	24	23	21	20	19	18	17	15	14	13	13	12	11	10	9	8	8	7	6	6	5	5	4
17.5	26	25	23	22	21	20	18	17	16	15	14	13	12	11	11	10	9	8	8	7	6	6	5
18.0	28	27	25	24	23	21	20	19	18	17	16	15	14	13	12	11	11	10	9	8	8	7	7
18.5	31	29	28	26	25	23	22	21	20	19	18	17	16	15	14	13	12	11	10	10	9	8	8
19.0	33	31	30	28	27	25	24	23	22	20	19	18	17	16	15	14	13	13	12	11	10	10	9
19.5	35	34	32	30	29	27	26	25	23	22	21	20	19	18	17	16	15	14	13	12	12	11	10
20.0	38	36	34	33	31	30	28	27	25	24	23	22	21	19	18	17	17	16	15	14	13	12	12
20.5	40	38	37	35	33	32	30	29	27	26	25	23	22	21	20	19	18	17	16	15	14	14	13
21.0	43	41	39	37	35	34	32	31	29	28	27	25	24	23	22	21	20	19	18	17	16	15	14
21.5	45	43	41	39	38	36	34	33	31	30	28	27	26	25	23	22	21	20	19	18	17	16	16
22.0	48	46	44	42	40	38	36	35	33	32	30	29	28	26	25	24	23	22	21	20	19	18	17
22.5	50	48	46	44	42	40	39	37	35	34	32	31	30	28	27	26	25	23	22	21	20	19	18
23.0	53	51	49	47	45	43	41	39	38	36	34	33	31	30	29	28	26	25	24	23	22	21	20
23.5	56	53	51	49	47	45	43	41	40	38	36	35	33	32	31	29	28	27	26	25	23	22	21
24.0	59	56	54	52	50	48	46	44	42	40	39	37	35	34	32	31	30	29	27	26	25	24	23
24.5	61	59	57	54	52	50	48	46	44	42	41	39	37	36	34	33	32	30	29	28	27	26	24
25.0	64	62	59	57	55	52	50	48	46	45	43	41	39	38	36	35	33	32	31	30	28	27	26
25.5	67	65	62	60	57	55	53	51	49	47	45	43	42	40	38	37	35	34	33	31	30	29	28
26.0	70	67	65	62	60	58	55	53	51	49	47	45	44	42	40	39	37	36	34	33	32	31	29
26.5	73	70	68	65	63	60	58	56	54	52	50	48	46	44	42	41	39	38	36	35	34	32	31
27.0	76	73	71	68	65	63	61	58	56	54	52	50	48	46	45	43	41	40	38	37	35	34	33
27.5	80	77	74	71	68	66	63	61	59	56	54	52	50	49	47	45	43	42	40	39	37	36	34
28.0	83	80	77	74	71	69	66	64	61	59	57	55	53	51	49	47	45	44	42	41	39	38	36
28.5	86	83	80	77	74	71	69	66	64	62	59	57	55	53	51	49	47	46	44	42	41	39	38
29.0	89	86	83	80	77	74	72	69	67	64	62	60	57	55	53	51	50	48	46	44	43	41	40
29.5	93	90	86	83	80	77	75	72	69	67	64	62	60	58	56	54	52	50	48	46	45	43	42
30.0	96	93	90	86	83	80	78	75	72	70	67	65	62	60	58	56	54	52	50	49	47	45	44
30.5	100	96	93	90	87	84	81	78	75	72	70	67	65	63	61	58	56	54	53	51	49	47	46
31.0		100	96	93	90	87	84	81	78	75	73	70	68	65	63	61	59	57	55	53	51	49	48
31.5			100	97	93	90	87	84	81	78	75	73	70	68	66	63	61	59	57	55	53	51	50
32.0				100	97	93	90	87	84	81	78	76	73	70	68	66	64	61	59	57	55	53	52
32.5					100	97	93	90	87	84	81	78	76	73	71	68	66	64	62	60	58	56	54
33.0						100	97	93	90	87	84	81	79	76	73	71	69	66	64	62	60	58	56
33.5							100	97	93	90	87	84	81	79	76	74	71	69	66	64	62	60	58
34.0								100	97	93	90	87	84	82	79	76	74	71	69	67	65	62	60
34.5									100	97	93	90	87	85	82	79	76	74	72	69	67	65	63
35.0										100	97	94	90	87	85	82	79	77	74	72	69	67	65
35.5											100	97	94	91	88	85	82	79	77	74	72	70	67
36.0												100	97	94	91	88	85	82	79	77	74	72	70
36.5													100	97	94	91	88	85	82	80	77	75	72
37.0														100	97	94	91	88	85	82	80	77	75
37.5															100	97	94	91	88	85	82	80	77
38.0																100	97	94	91	88	85	83	80
38.5																	100	97	94	91	88	85	83
39.0																		100	97	94	91	88	85
39.5																			100	97	94	91	88
40.0																				100	97	94	91
40.5																					100	97	94
41.0																						100	97
41.5																							100
42.0																							
42.5																							
43.0																							
43.5																							
44.0																							
44.5																							
45.0																							
45.5																							
46.0																							
46.5																							
47.0																							
47.5																							
48.0																							
48.5																							
49.0																							
49.5																							
50.0																							
50.5																							
51.0																							
51.5																							
52.0																							
52.5																							
53.0																							

WET BULB TEMPERATURE °C

DRY BULB TEMPERATURE °C

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DRY BULB TEMPERATURE °C

WET BULB TEMPERATURE °C

	42.0	42.5	43.0	43.5	44.0	44.5	45.0	45.5	46.0	46.5	47.0	47.5	48.0	48.5	49.0	49.5	50.0	50.5	51.0	51.5	52.0	52.5	53.0	
11.0																								11.0
11.5																								11.5
12.0																								12.0
12.5																								12.5
13.0																								13.0
13.5																								13.5
14.0																								14.0
14.5																								14.5
15.0																								15.0
15.5																								15.5
16.0	1	1	1																					16.0
16.5	3	2	2	1	1																			16.5
17.0	4	3	3	2	2	1	1	1																17.0
17.5	5	4	4	3	3	2	2	2	1	1	1													17.5
18.0	6	5	5	4	4	3	3	3	2	2	2	1	1	1										18.0
18.5	7	7	6	6	5	5	4	4	3	3	2	2	2	1	1	1	1							18.5
19.0	8	8	7	7	6	6	5	5	4	4	3	3	3	2	2	2	1	1	1					19.0
19.5	10	9	8	8	7	7	6	6	5	5	4	4	4	3	3	2	2	2	2	1	1	1		19.5
20.0	11	10	10	9	8	8	7	7	6	6	5	5	4	4	4	3	3	3	2	2	2	1	1	20.0
20.5	12	11	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	3	3	3	3	2	2	20.5
21.0	14	13	12	11	11	10	9	9	8	8	7	7	6	6	6	5	5	4	4	4	3	3	3	21.0
21.5	15	14	13	13	12	11	11	10	9	9	8	8	7	7	6	6	6	5	5	4	4	4	3	21.5
22.0	16	15	15	14	13	12	12	11	11	10	9	9	8	8	7	7	7	6	6	5	5	5	4	22.0
22.5	18	17	16	15	14	14	13	12	12	11	11	10	9	9	8	8	7	7	7	6	6	5	5	22.5
23.0	19	18	17	16	16	15	14	14	13	12	12	11	10	10	9	9	8	8	7	7	7	6	6	23.0
23.5	20	20	19	18	17	16	15	15	14	13	13	12	11	11	10	10	9	9	8	8	7	7	7	23.5
24.0	22	21	20	19	18	17	17	16	15	15	14	13	13	12	11	11	10	10	9	9	8	8	8	24.0
24.5	23	22	21	21	20	19	18	17	16	16	15	14	14	13	12	12	11	11	10	10	9	9	8	24.5
25.0	25	24	23	22	21	20	19	18	18	17	16	15	15	14	14	13	12	12	11	11	10	10	9	25.0
25.5	27	25	24	23	22	22	21	20	19	18	17	17	16	15	15	14	13	13	12	12	11	11	10	25.5
26.0	28	27	26	25	24	23	22	21	20	19	19	18	17	16	16	15	14	14	13	13	12	12	11	26.0
26.5	30	29	27	26	25	24	23	22	22	21	20	19	18	18	17	16	16	15	14	14	13	13	12	26.5
27.0	31	30	29	28	27	26	25	24	23	22	21	20	20	19	18	17	17	16	15	15	14	14	13	27.0
27.5	33	32	31	29	28	27	26	25	24	23	22	22	21	20	19	18	18	17	16	16	15	14	14	27.5
28.0	35	34	32	31	30	29	28	27	26	25	24	23	22	21	20	20	19	18	17	17	16	16	15	28.0
28.5	37	35	34	33	32	30	29	28	27	26	25	24	23	22	22	21	20	19	19	18	17	17	16	28.5
29.0	38	37	36	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	20	19	18	18	17	29.0
29.5	40	39	37	36	35	34	32	31	30	29	28	27	26	25	24	23	22	22	21	20	19	19	18	29.5
30.0	42	41	39	38	36	35	34	33	32	30	29	28	27	26	25	25	24	23	22	21	20	20	19	30.0
30.5	44	42	41	40	38	37	36	34	33	32	31	30	29	28	27	26	25	24	23	22	22	21	20	30.5
31.0	46	44	43	41	40	39	37	36	35	34	32	31	30	29	28	27	26	25	24	24	23	22	21	31.0
31.5	48	46	45	43	42	40	39	38	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	31.5
32.0	50	48	47	45	44	42	41	39	38	37	35	34	33	32	31	30	29	28	27	26	25	24	24	32.0
32.5	52	50	49	47	45	44	42	41	40	38	37	36	35	33	32	31	30	29	28	27	26	26	25	32.5
33.0	54	52	51	49	47	46	44	43	41	40	39	37	36	35	34	33	32	31	30	29	28	27	26	33.0
33.5	56	54	53	51	49	48	46	45	43	42	40	39	38	37	35	34	33	32	31	30	29	28	27	33.5
34.0	58	57	55	53	51	50	48	46	45	43	42	41	39	38	37	36	35	33	32	31	30	29	28	34.0
34.5	61	59	57	55	53	51	50	48	47	45	44	42	41	40	38	37	36	35	34	33	32	31	30	34.5
35.0	63	61	59	57	55	53	52	50	49	47	45	44	43	41	40	39	38	36	35	34	33	32	31	35.0
35.5	65	63	61	59	57	56	54	52	50	49	47	46	44	43	42	40	39	38	37	36	34	33	32	35.5
36.0	68	65	63	61	59	58	56	54	52	51	49	48	46	45	43	42	41	39	38	37	36	35	34	36.0
36.5	70	68	66	64	62	60	58	56	54	53	51	49	48	46	45	44	42	41	40	38	37	36	35	36.5
37.0	72	70	68	66	64	62	60	58	56	55	53	51	50	48	47	45	44	43	41	40	39	38	36	37.0
37.5	75	73	70	68	66	64	62	60	58	57	55	53	52	50	48	47	46	44	43	42	40	39	38	37.5
38.0	78	75	73	71	68	66	64	62	60	59	57	55	53	52	50	49	47	46	44	43	42	41	39	38.0
38.5	80	78	75	73	71	69	67	65	63	61	59	57	55	54	52	50	49	48	46	45	43	42	41	38.5
39.0	83	80	78	75	73	71	69	67	65	63	61	59	57	56	54	52	51	49	48	46	45	44	42	39.0
39.5	86	83	80	78	76	73	71	69	67	65	63	61	59	58	56	54	53	51	50	48	47	45	44	39.5
40.0	88	86	83	81	78	76	74	71	69	67	65	63	61	60	58	56	54	53	51	50	48	47	46	40.0
40.5	91	88	86	83	81	78	76	74	71	69	67	65	63	62	60	58	56	55	53	52	50	49	47	40.5
41.0	94	91	88	86	83	81	78	76	74	72	70	67	66	64	62	60	58	57	55	53	52	50	49	41.0
41.5	97	94	91	89	86	83	81	79	76	74	72	70	68	66	64	62	60	58	57	55	54	52	51	41.5
42.0	100	97	94	91	89	86	83	81	79	76	74	72	70	68	66	64	62	60	59	57	55	54	52	42.0
42.5		100	97	94	91	89	86	84	81	79	76	74	72	70	68	66	64	62	61	59	57	56	54	42.5
43.0			100	97	94	91	89	86	84	81	79	77	74	72	70	68	66	64	63	61	59	57	56	43.0
43.5				100	97	94	91	89	86	84	81	79	77	75	72	70	68	66	65	63	61	59	58	43.5
44.0					100	97	94	92	89	86	84	81	79	77	75	73	71	69	67	65	63	61	59	44.0
44.5						100	97	94	92	89	86	84	82	79	77	75	73	71	69	67	65	63	61	44.5
45.0							100	97	94	92	89	87	84	82	79	77	75	73	71	69	67	65	63	45.0
45.5								100	97	94	92	89	87	84	82	79	77	75	73	71	69	67	65	45.5
46.0									100	97	94	92	89	87	84	82	80	77	75	73	71	69	67	46.0
46.5										100	97	94	92	89	87	84	82	80	78	75	73	71	69	46.5
47.0											100	97	94	92	89	87	84	82	80	78	76	73	71	47.0
47.5												100	97	95	92	89	87	84	82	80	78	76	74	47.5
48.0													100	97	95	92	89	87	85	82	80	78	76	48.0
48.5														100	97	95	92	89	87	85	82	80	78	48.5
49.0															100	97	95	92	90	87	85	82	80	49.0
49.5																100	97	95	92	90	87	85	83	49.5
50.0																	100	97	95	92	90	87	85	50.0
50.5																		100	97	95	92	90	87	50.5
51.0																			100	97	95	92	90	51.0
51.5																				100	97	95	92	51.5
52.0																					100	97	95	52.0
52.5																						100	97	52.5
53.0																							100	53.0
	42.0	42.5	43.0	43.5	44.0	44.5	45.0	45.5	46.0	46.5	47.0	47.5	48.0	48.5	49.0	49.5	50.0	50.5	51.0	51.5	52.0	52.5	53.0	

DRY BULB TEMPERATURE °C

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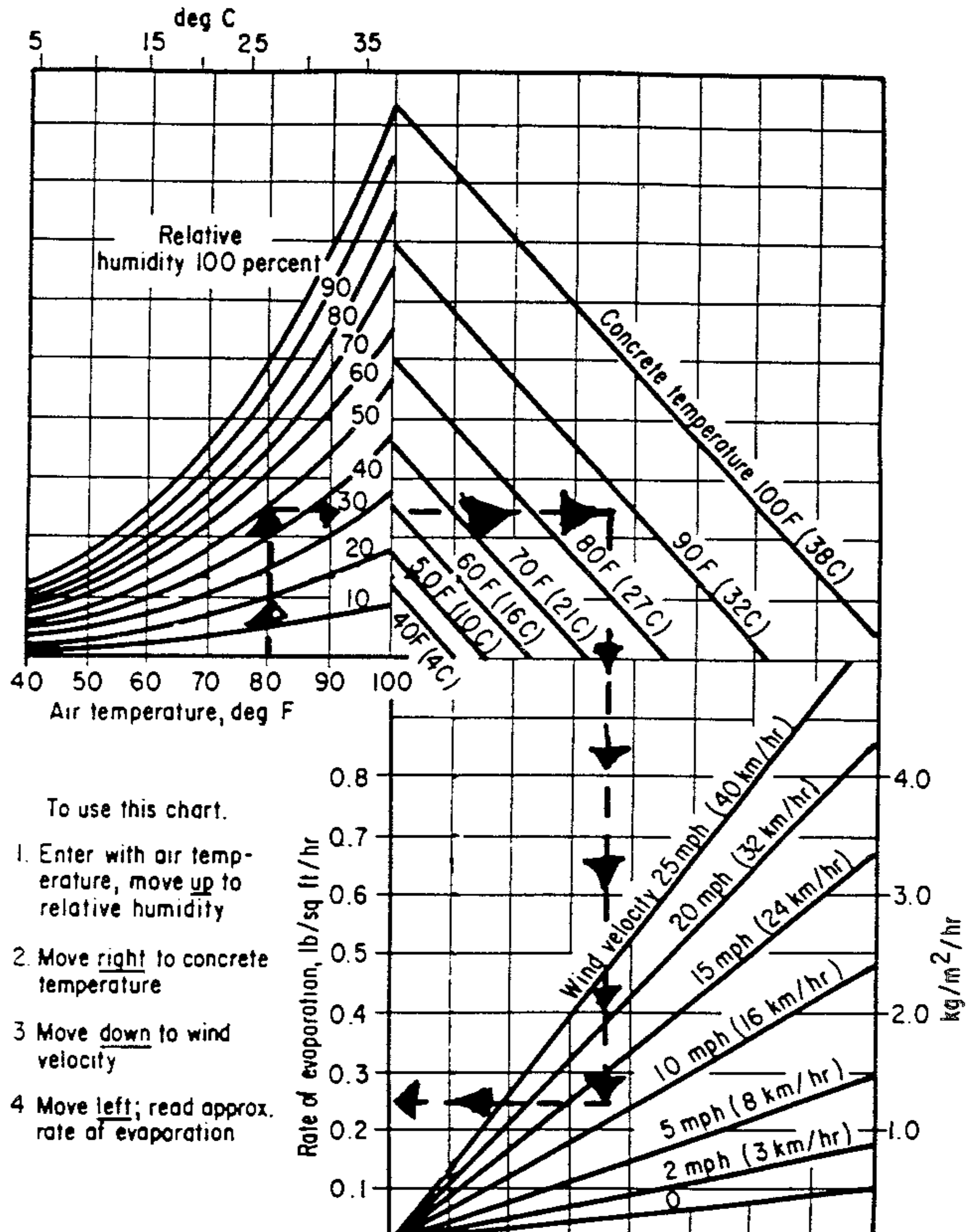
Figure 2—Evaporation Rate Chart



Effect of concrete and air temperatures, relative humidity, and wind velocity on the rate of evaporation of surface moisture from concrete.

Idaho Standard Practice for

Field Sampling of Hydraulic Cement and Fly Ash

Idaho IR-143-07

1 Scope

This method covers obtaining the required field samples of hydraulic cement and fly ash from bulk shipments by means of the ITD in-line sampler.

2 Apparatus

2.1 In-line sampler with couplers fitting a 4” line

2.2 5” coupler adaptor

2.3 In-line sample container

2.4 Two 4” to 5” hose adaptors (1 female, 1 male)

2.5 Rubber mallet

2.6 4” pipe brush

2.7 ½” pipe brush

2.8 Manual for assembly and cleaning of in-line sampler

Refer to the Manual for details on assembly.

2.9 Pelican 1650 transport & storage case

3 Procedure

3.1 Before the line is pressurized, connect the sampler to the discharge tube on the trailer of the bulk cement truck and secure with the Kam-Loc levers.

3.2 Connect the rubber hose / line which feeds cement into the silo or bins to the sampler and secure with Kam-Loc levers.

3.3 Strike Kam-Loc levers with rubber hammer until connectors are secure.

3.3.1. Note: The ring on the lever must be toward the outside in order to open the lever. The ball valve must be in closed position before the line is pressurized.

3.4 After 5 minutes of unloading, carefully open the ball valve to ensure that cement comes out of the valve, to verify the sample container is full.

3.5 Close the valve.

3.6 Allow the truck to depressurize.

3.7 Remove sampler after the line has been depressurized.

3.8 Remove container portion of the sampler and pour sample into a suitable sample container.

3.9 Properly label sample container with a permanent marker and complete the ITD-1044 Sample Data form with a copy of the mill analysis certification attached.

3.10 The sampler must be thoroughly cleaned after each sample is taken by following the directions in the sampler manual.

Idaho Standard Method of test for

Lithium Dosage Determination Using Accelerated Mortar Bar Testing

Idaho IT-145-12

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1. Scope

1.1 Lithium compounds have been shown to control expansion due to Alkali Silica Reactivity (ASR). This test method outlines the procedure necessary to determine the ideal dosage of lithium nitrate ($LiNO_s$) for use as an admixture in fresh concrete.

2. References

2.1 AASHTO: T-303

2.2 ASTM: C-1260, C-1567

3. Apparatus and Tools

3.1 Refer to AASHTO T-303 for test apparatus and tools.

4. Test Specimen Preparation

4.1 Refer to AASHTO T-303 for sampling and preparation of test specimens

5. Procedure

5.1 For each coarse, fine and intermediate aggregate perform the following procedures

5.1.1 Control Test – Refer to AASHTO T-303 for test procedure, except continue taking measurements for 28 days.

5.1.2 Lithium Nitrate Dosage Test – Refer to AASHTO T-303 for test procedure except:

5.1.2.1 Add 0.74 ratio of [Li/(Na+K)] to the mixing water using the following equations (refer to section 6 for an example):

A = C x (P/100)

Where:

A = Alkali content

C = cement content

P = % Na_2O equivalent in cement

d = A x 4.63

Where:

d =dosage of $LiNO_3$ 30% solution added to the mixing water (ml).

D = d x 1.2
Where:
D = dosage of $LiNO_3$ 30% solution added to the mixing water (g).

W = w – (D x 0.7)
Where:
w = Water content (g)
W = adjusted water content to account for water in $LiNO_3$ 30% solution (g).

5.1.2.2 Add 0.148 ratio of [LI/Na] to the soak solution. To produce 1 L of soak solution, add 500 ml of 2M Standard NaOH to a 1L volumetric flask, followed by 28.4 ml of $LiNO_3$, and then add de-ionized water to the 1000 ml mark.

5.1.2.3 Continue taking measurements until 28 days.

6. Calculations

6.1 Calculate the expansion of each test according to AASHTO T-303
Where:
E_1 = 28 day expansion of the control test
E_2 = the 28 day of the Lithium Nitrate Dosage Test.

6.2 Calculate the ratio [Li/(Na +K)] to be used as an admixture.
Ratio = 1.0 +0.7[(E_2-E_1)/ E_1]

6.3 Calculate the amount of Lithium in gallons needed per pound of alkalis:
G=(ratio/0.74) x(0.55 gal/lb Na_2O_{eq})
Where G= gallons of 30 % $LiNo_3$ of alkalis.
Note : for low alkali cement use 0.6 % Na_2O_{eq}.

7. Example

7.1 The following example performs the required calculations of section 5.1.2 for the testing of three mortar bars.

7.1.1 Given:

$C = 440g$

$P = 0.52\%$

$w=220g$

7.1.2 Therefore:

$A = C \times (P/100) = 440 \times (0.52/100) = 2.29g$

$d = A \times 4.63 = 2.29 \times 4.63 = 10.6ml$

$D = d \times 1.2 = 10.6 \times 1.2 = 12.7g$

$W = w - (D \times 0.7) = 220 - (12.7 \times 0.7) = 211.1g$

7.2 The following example performs the required calculation required in section 6 for determining the lithium nitrate dosage.

7.2.1 Given:

$E_1 = 0.82\%$ as determined by AASHTO T-303 extended to 28 days

$E_2 = 0.34\%$ as determined above at 28 days

$Ratio = 1.0 + 0.7[(E_2 - E_1)/ E_1] = 1 + 0.7[(0.34 - 0.82)/0.82] = 0.59$

7.2.2 Therefore:

$G = (ratio/0.74) \times (0.55 \text{ gal/lb } Na_2O_{eq}) = (0.59/0.74) \times (0.55) = 0.44$ gal/lb alkalis

8. Report

8.1 Report all information required per AASHTO T-303 plus all additional calculations.

Idaho Standard Practice for

Inspecting / Sampling Paint and Curing Compound

Idaho IR-7-04

1 Scope

1.1 This method is intended to cover the inspection and sampling of product components and production batches of paints and curing compounds.

2 References

2.1 ASTM D 3925 Standard Practice for Sampling Liquid Paints and Related Pigmented Coatings

2.2 Federal Standard Test Methods 141

Method 1022 Sampling for Inspection and Testing

3 Terminology

3.1 Batch – A batch is defined as a unit or quantity of material produced at one (1) operation, the weight and volume of which may vary, depending on the manufacturing facilities. As an example, a number of small mill grinds may be combined together in a larger mixer. This material will be considered as one (1) batch and should be labeled as such. Similarly, when a number of varnish cooks are reduced in the same tank the combined reduced material shall be considered as one (1) batch.

3.2 Boxing – Boxing is a method by which a product that is exhibiting settlement is uniformly remixed without the use of power agitation equipment. (Boxing is accomplished by pouring approximately 60% of the liquid portion of the material into a new clean container that is the same size or larger than the package product. Stir the remaining liquid and the settled portions of the material into a uniform thin paste.) The previously removed liquid portion is then poured slowly and with constant stirring back into the original container. The contents are finally poured back and forth from container to container until the product is uniformly mixed and a representative sample can be taken.

3.3 Inspection – Refers to the collection of documentation and visual observation of materials. Inspection does not necessitate the destruction of the packaging or physical alteration of the product. Inspection should include the examination and reporting of the condition of the material in containers, number of units involved, type, class, grade, color, review of manufacturer's documentation, or other visual considerations of the units as may be called out in the product specifications. Inspection may also include the witnessing of a sample being taken by an authorized manufacturer's representative.

3.4 Cake – Dry settlement found in the bottom of a container.

4 Apparatus

4.1 One quart metal cans for solvent based curing compounds and paints.

4.2 One quart lined metal cans for water based curing compounds and paints.

4.3 Mixing equipment consisting of stir paddles, jiffy mixers, shakers, air stirrers, mechanical roller mixers, recirculation pumps, and buckets for boxing.

4.4 Dry pigment sampling equipment consists of Keystone Sampler and Splitter.

5 Sampling at Locations

5.1 Manufacturing Plant

5.1.1. Materials are generally packaged and ready for shipment at the time of arrival of the inspector. However, in some instances when large amounts of material are involved, the manufacturer may not have filled the containers, but will hold the material in a large tank until the inspector arrives. Samples will be collected from either the containerized products or from the holding tanks.

5.2 Project Site or Fabrication Plant

5.2.1. The packaged materials are at the project site or fabrication plant and will be sampled by the inspector.

6 Inspection and Sampling Procedures

6.1 Products are inspected for uniformity and samples are taken for the purpose of having a representative quantity, from each batch of material, for physical examination and laboratory testing. The samples will be analyzed to ascertain if the materials meet the specification requirements, the covering product specification, and to determine uniformity within a batch.

6.2 No set of directions for sampling, however explicit, can take the place of judgment, skill and previous experience on the part of a person actually engaged in the sampling and in the supervision of the sampling. These directions are intended to supplement this experience and to serve as a guide in the selection of the sampling method.

6.3 All containers shall be marked with the production batch number, date of manufacture, and product name. At least one (1) sample shall be taken from each batch.

6.4 For all grades of materials, precautions shall be taken to assure the sampling apparatus and the samples themselves are not contaminated and are clean and dry. Slight contamination of the product may lead to false test results. Use the appropriate container for the type of material that is being sampled (Refer to Section 3.1 and 3.2).

6.5 The batches shall be sampled according to the applicable plan as describe within this method. Samples shall be selected at random so that they are representative of the batch.

6.6 The samples shall be of such size as to permit the performance of all inspections and laboratory tests. In most cases, one (1) quart of liquid or one (1) pound of dry material is sufficient.

6.7 To the extent possible, it is advisable that original, unopened containers within each batch be selected as samples. When individual containers are less than the one (1) quart or one (1) pound size a sufficient number of containers shall be selected to achieve the required size. Obviously it is not always convenient or economical to have samples of very large size be submitted for testing. In these cases, care must be exercised so that samples are uniform and representative of the batch of material.

6.8 For dry pigments and resins, the package shall be opened by the inspector and a representative sample taken at random from the contents. This sample shall be placed in a clean, dry, metal container closed with an air tight cover, sealed, marked and sent to the Central Laboratory.

6.9 For liquid material the original unopened containers shall be sent to the Central Laboratory. When this is not applicable the inspector shall determine, by thorough testing with a paddle or spatula, if the material meets the absence of caking requirements in the container. The inspector shall thoroughly mix the contents of the container and draw a sample as specified, normally not less than one (1) quart. This sample shall be placed in a suitable clean and dry container. The sample should be filled as full as possible to minimize air contact within the container. The container is then closed with a tight cover, sealed, marked and sent to the Central Laboratory for testing.

6.9.1. With material that has a significant amount of pigment added such as single component zinc paint the zinc settles out rather quickly. The zinc needs to be mixed extensively by the use of a jiffy mixer so that the zinc is suspended back into the binder. Continue agitation with the mixer while taking a sample to insure proper sampling of the material.

6.10 The sample container should be dry and not cooler than room temperature. Because pigmented products are dispersions and not solutions, finely divided pigment particles may settle upon standing. Consequently, thorough and careful agitation of the product before sampling is necessary to restore the product to its original, uniform condition. The method of agitation or stirring is therefore of prime importance.

6.11 6.11 Do not place samples in plastic bottles because volatile solvents may diffuse through the walls. Loss of the solvents may introduce errors in such tests as viscosity, weight per gallon and nonvolatile content as well as other properties. (Refer to Section 3.1 and 3.2 for the appropriate containers.) Place either safety clips or a safety ring on the lid of the sample container prior to shipping

6.12 When representative samples have been obtained and packaged in clean closed containers send them promptly to the Central Laboratory for testing along with all the batch and product information.

6.13 During the period between sampling and delivery, it is important that samples be kept at temperatures from 40 to 90°F. Extreme temperatures may change the properties of some products.

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7 Uniformity of Samples

7.1 Clear Liquid Products. Clear liquid products require stirring prior to sampling to achieve uniformity and a representative sample. Care must be taken so that any separation, sediment, gel or other matter indicative of non-uniformity is reincorporated back into the product prior to sampling.

7.2 Pigment Liquid Products. Pigmented liquid products require stirring prior to sampling to achieve uniformity and a representative sample. Where there is settling, or separation of constituents, these should be reincorporated by “boxing” or other means of agitation that will sufficiently homogenize the sample to uniformity prior to sampling.

7.3 Dry Pigments and Powders. Ordinarily dry pigments, powders, hard resins, etc. are more likely to be uniform than pigmented liquids. Care must be exercised to ensure that samples of these materials are representative of the batch being sampled. For sampling very large containers of these materials a Keystone Sampler and Sample Splitter should be used.

8 Sampling According to Container Size

8.1 Containers Smaller Than 5 Gallons.

8.1.1. When the batch to be sampled is contained in multiple small containers and batch numbers are marked on the containers, put all containers from the same batch together. From each batch select at random one percent (1%) of the containers, but not more than five (5) containers, for sampling. For example, it there are 275 containers in a batch, randomly select three (3) for sampling. A minimum of one (1) sample is required per batch.

8.1.2. After selection of the containers to be sampled, thoroughly agitate or stir the contents. Acceptable methods of mixing are mechanical shaking or stirring, or hand stirring with a paddle, followed by boxing. Mechanical shakers are desirable for most materials since there is thorough agitation in a closed container. Before mechanical shaking, open the container and check to be sure that the pigment has not caked on the bottom of the container. If caking exists, stir manually or with a jiffy mixer to break up the hard settling and then put the containers on the mechanical shaker again. Agitate products having a weight per gallon of 11 lbs/gal or less on the shaker for 5 minutes and those with a weight per gallon of more than 11 lbs/gal for 10 minutes. After agitation, check the products for uniformity again before sampling. If the product is not uniform repeat the process until the product is brought into uniform consistency. After thorough agitation decant a one (1) quart can full and send to the Central Laboratory for testing.

8.2 Containers Larger than 5 Gallons.

8.2.1. From each batch select at random five percent (5%) of the containers, but not more than three (3) containers, for sampling. A minimum of one (1) sample is required per batch. Drums may be stirred satisfactorily by several means. With open-head types, mechanical or manual stirring may be used. Some drums contain their own agitators; drum shakers or rollers may also be used. After agitation, check the products for uniformity again before sampling. If the product is not uniform repeat the process until the product is brought into uniform consistency. After thorough agitation decant a one (1) quart can full and send to the Central Laboratory for testing.

8.3 Containers from 250 to 500 Gallons (Totes)

8.3.1. From each batch randomly select one (1) tote per 5000 gallons of material for testing. For example if the batch represents 12,000 gallons take three (3) samples from three (3) separate totes within the batch. The material shall be thoroughly agitated by using mechanical mixers or recirculating the material. Recirculating the material shall be done until the entire contents have been turned over within the tote a minimum of three (3) times. The pump rate shall be adequate to achieve this recirculation rate of the material within 1 hour. Alternatively the material may be pump into an empty tote and then pumped back and forth, a minimum of three (3) times, similarly to boxing the material until the material is thoroughly agitated and mixed. Once complete mixing has been accomplished open the valve of the tote and allow a minimum of 2 gallons of product to flow into a 5 gallon bucket. Examine the product for uniformity and then take a one (1) quart sample from the 5 gallon bucket and send it to the Central Laboratory for testing.

8.3.1.1. Care should be used in pump selection as the gear driven pumps can cause shearing in waterborne products causing the emulsion components to separate.

8.4 Alternative Sampling Procedure.

8.4.1. When it is impractical, inconvenient, or dangerous to take samples as described above, and where permitted, samples may be taken in the manufacturer's plant during filling operations or in the production line as applicable. In such cases samples should be taken near the beginning, in the middle, and near the end of the operation. These individual samples should be a minimum of one (1) quart each. Sampling in this manner must be supervised by a representative of the purchaser. Once the three (3) samples have been collected mix them together uniformly, decant the product into a one (1) quart can and send the sample to the Central Laboratory.

8.5 Composite Samples.

8.5.1. While not recommended, occasionally composites samples may be permitted for economy in testing. The use of composite samples requires prior approval of the Central Laboratory. When permitted a composite sample shall be used to represent the batch of material in its final state.

9 Disposition of Samples

9.1 Unless otherwise specified each sample taken as directed herein shall be sealed in a clean, dry one (1) quart size container and marked so as to clearly identify the batch number of material involved. Unless otherwise specified, each sample shall be inspected and sampled in accordance with these specifications. Failures of any sample to meet the product specification requirements shall be cause for rejection of the material.

10 Termination of Sampling

10.1 When in the course of sampling, the material is found to have serious and obvious defects sampling shall be terminated and resumed only after defects have been corrected or the defective material is replaced.

11 Time of Sampling

11.1 Samples shall be taken as soon as possible after manufacturing or delivery to a site location.

12 Laboratory Testing Time

12.1 Allow a minimum of two (2) weeks for test results on all products after they have been received into the Central Laboratory.

Idaho Standard Practice for

Determining Total Solids-Latex Percent

Idaho IR-121-98

1 Scope

1.1 This involves the determination of the percent of solids on all latex samples. It involves weighing a sample of wet latex, drying it in an oven, and expressing the weight ratio of dry/wet in percent.

2 Procedure

2.1 All samples to be tested must be at room temperature. If the sample is warm, it can be cooled in a pan of cold tap water.

2.2 Weigh three (3) aluminum cups and record the weight of each (tare weight).

Note: Every sample tested must be done in triplicate.

2.3 Mix by hand each sample when cool by inverting the container five (5) to ten (10) times.

2.4 Weigh approximately one (1) gram of latex to the nearest milligram into each preweighed aluminum cup.

2.5 Place all three (3) samples in the oven to dry for 120 minutes at a temperature of $285^{o}F \pm 2^{o}F$ ($140^{o}C \pm 1^{o}C$).

2.6 Remove the samples from the oven and place immediately in a desicator for a few minutes or until cool. This prevents moisture pick-up from the air while cooling.

2.7 Reweigh each sample out of the desicator to the nearest milligram and record.

3 Calculations and Report

$$\text{Total solids in percent} = \frac{C - A}{B - A} \times 100$$

Where:

A = The weight of the empty cup
B = The weight of the aluminum cup and the wet sample
C = The weight of the aluminum cup and the dried sample

3.1 Example:

If A = 1.374 g
B = 2.356 g
C = 1.779 g

Then C - A = 1.779 - 1.374 = 0.405 g

B - A = 2.356 - 1.374 = 0.982 g

Therefore $\frac{C - A}{B - A} \times 100 = \frac{0.405}{0.982} \times 100 = 41.2\%$ solids

3.2 If all three (3) samples are within 2%, average the three (3) samples to obtain the percent solids.

3.3 If all three (3) samples are not within 2%, but two (2) samples are within 1%, report the average between the two (2) samples within 1% as the percent solids and discard the third determination.

3.4 If all three (3) samples are not within 2% and no two (2) are within 1%, discard all the values and repeat the solids procedure.

Idaho Standard method of Test for

Resistance R-Value and Expansion Pressure of Compacted Soils and Aggregates

Idaho IT-8-11

ITD Standard Specification Designation: Idaho T-8

This method covers the procedures for determination of Resistance R- value and Expansion Pressure for compacted soils or aggregates. This test method is divided into the following parts:

I. Method of Preparation of Materials

II. Method of Compaction for Test Specimen

III. Method of Determination of Exudation Pressure

IV. Method of Determination of Expansion Pressure

V. Method of Determination of Resistance R-value by Means of the Hveem Stabilometer

VI. Method of Calculating the Densities of Test Specimens

PART I. METHOD OF PREPARATION OF MATERIALS

1. Scope

This part of the procedure describes the methods of batching , mixing and curing of the materials.

2. Apparatus

2.1 Mechanical mixer.
2.2 Scales, 5000 g. capacity, accurate to 1.0 g.
2.3 Scales, 175 lb. capacity, with 0.1 lb. graduations.
2.4 Set of screens, 3", 2", 1", 3/4", 1/2", and No. 4.
2.5 Fiberglass pans and cover.
2.6 Vinyl plastic sheets large enough to cover fiberglass pans.
2.7 Burette or graduated cylinder for measuring water.
2.8 Riffle splitter with chutes 3/4" wide.

3. Test Record Form

Keep all pertinent data regarding the soil sample on the ITD-899 Preliminary Soils Worksheet.

4. Preparation of Sample

4.1 Refer to Test Method AASHTO R 58 for preparation of samples.
4.2 The preparation of test samples must include removal of coatings from coarse aggregates, and clay lumps must be broken down to pass the No. 4 sieve. This is important because

relatively small test samples are used. It is also important that the test sample be accurately prepared.

5. Determining of Grading and Batch Weights Used in Preparing Test Samples

5.1 Definitions of "Original" and "As used" grading:

“Original”: Original grading is grading on a sample prior to any adjustment such as scalping, wasting, or crushing.

"As used": As used grading is the grading after the material has been adjusted as necessary to meet the specifications or to eliminate material too large to test. This adjusted grading is referred to as the "As used' grading. In cases where 100% of the material as received passes the 3/4" sieve and no adjustments are necessary, the "Original" and the "As used" grading will be the same.

5.2 Criteria for scalping (removing the oversize material) samples containing oversize material.

5.2.1 If 75% or more of the sample as received passes the 3/4" sieve, scalp the sample on the 3/4" sieve.

5.2.2 If less than 75% of the sample as received passes the 3/4" sieve, scalp the sample on the 1" sieve.

5.3 A total of 13 lb. is used to ensure sufficient material for five specimens and a moisture sample.

5.4 Calculations required for determining the "As used" grading are as in the following example:

Given an aggregate with the following grading:

More than 75% of the sample as received passes the 3/4" sieve, so scalp materials above the 3/4" sieve.

Sieve	Original % Passing	Corrected % Passing	Corrected % Retained	Accumulated Weight, Lb.
1"	90			
3/4"	85	100	0	0
1/2"	75	88	12	1.6
No. 4	65	77	23	3.0
Weight of Sample				13.0 lb.

Using the above example, weigh out 1.6 lb. (13 x 12/100) of retained 1/2" materials; add to this 1.4 lbs (13 x (23-12)/100) of retained No. 4 material and 10.0 lb. of minus No. 4 material to make a total of 13.0 lb.

If the corrected percent retained on the No. 4 sieve is less than 6%, no plus No. 4 material need be added and the sample is treated as though 100% passed the No. 4 sieve.

5.5 Add to the sample enough water to approach optimum. This operation is performed by placing the 13.0 lb. sample in the mechanical mixer and adding water. The amount of water added is left to the discretion of the operator and need not be recorded. Continue mixing for at least 30 seconds after the water has been added. The period of mixing given is a minimum requirement. Place the sample in a large fiberglass pan and cover with a plastic sheet in order to prevent moisture loss. Allow to stand overnight.

5.6 Before preparing the individual test specimens, an initial moisture sample of approximately 500 g having the same grading as the test sample is taken. The moisture content is determined by weighing before and after drying to constant weight at temperature of 220-230°F.

5.7 The R-value test requires the preparation of three or four test specimens at different moisture contents. The first specimen is used as a pilot specimen. After completing the pilot specimen, it can be used as a guide in the preparation of the other three specimens, which shall conform to the following limitations:

Height = 2.5 ± 0.05 inches
Exudation: One should be above and two below the 2,500 lb. exudation load (200 psi pressure) or two above and one below 2,500 lb. load. The exudation load should be between 1000 and 5000 lbs.

Should the pilot specimen satisfy both height and exudation load requirements, it may be used as one of the sample specimens and only three (two additional) specimens need be fabricated. It often requires about 1000 g to 1100 g of material to produce a specimen of proper height. Experience will help in amount selection. Any correction of amount necessary may be made by use of the chart in Figure 1.

5.8 The amount of water needed to bring the exudation pressure into one of the above ranges is added to the soil and mixed in the mechanical mixer. Very granular and sandy materials can be mixed as thoroughly and as easily with a pan and trowel. It is necessary here to record the amount of water added.

With the use of the mixing machine, about 30 seconds at a moderate speed is ample time to mix the material. Any amount of time over this may cause excessive loss of water due to evaporation.

5.9 To obtain a representative test specimen when the sample contains plus No. 4 material, proceed as follows:

5.9.1 Roll the 13.0 lb. sample on a plastic splitting cloth.
5.9.2 From the thoroughly rolled and mixed material, scoop out a representative portion for the test specimen.

5.9.3 Thoroughly roll the sample again and scoop out the material for the next specimen.
5.9.4 Obtain all additional specimens in this manner.

5.10 To prevent evaporation loss of moisture, keep samples covered at all times except during immediate processing.

PART II. METHOD OF COMPACTION FOR TEST SPECIMEN

1. Scope

This part of the method describes the compaction procedure for test specimens using a kneading compactor. The kneading compactor densifies the material without depending on straight compression or damaging impact, but rather by a series of individual impressions made with a ram having a face shaped as a sector of a 4" diameter circle. The kneading action is developed by the application of pressures alternately to small localized areas of the specimen while the remainder of the surface is free to move.

2. Apparatus

2.1 Kneading compactor (Figure 2).
2.2 Tared steel molds 4" height.
2.3 Mold holders.
2.4 Basket fabrication equipment.
2.5 Paper strips for making baskets.
2.6 Supply of phosphor-bronze perforated disks.
2.7 Supply of 4" diameter manila disks.
2.8 Weighted brass rod.
2.9 Trowel shaped to fit trough on compactor.
2.10 Separate trough and trowel for use with soils requiring baskets.
2.11 1/2" x 4" steel disk.

3. Preparation of Sample

Sample is prepared as in Part I.

4. Procedure

4.1 Place mold in mold holder with 1/4" thick shims between bottom of mold and base of mold holder. Place 4" diameter manila disk over 3 15/16" diameter and 1/8" thick rubber disk in bottom of mold. Place the assembled mold and holder on the compactor turntable and tighten with thumb screws.

4.2 Place well mixed sample in compactor feeder trough with the loose material distributed evenly along the full length.

4.3 Using trowel formed to fit feeder trough, push the lower three inches of material in the trough into the mold. Start compactor and maintain 75 psi foot pressure, if possible. The compactor is adjusted to give 30 blows per minute. Push the remainder of the material into the mold in 20 equal parts, using two blows of the compactor for each part of material, for a total of 40 blows. Constant adjustment of the mold stage must be made to obtain the correct length of stroke. The correct length of stroke does not allow the piston to strike the base of the cylinder, thus ensuring continuous pressure on the specimen during the loading part of the cycle. A mark is scribed on the foot guide giving a 3/4" clearance between the piston and the cylinder base. When all the material is in the mold, raise and clean the compactor foot. Remove the shims beneath the mold. Put a 4" diameter, 1/8" thick rubber disk on top of the soil and tamp 100 more times while maintaining the pressure at100 psi for these 100 blows, if possible.

4.4 Clays and clean sands may require lower compaction pressures. In these cases, use the greatest compaction pressure possible, but do not allow the foot to penetrate over 1/4" into the surface after all the material is in the mold. If the pressure is reduced, record the pressure used.

4.5 If free water appears around the bottom of the mold during compaction, stop the compactor immediately and note the number of blows. In all probability, the sample is too wet.

4.6 If the surface is left uneven by the action of the compactor foot, smooth and level the surface by gently tamping with the weighted rod. A square tipped spatula is helpful in removing the accumulation of material around the edge of the mold. Return the mold to the compactor with a 1/2" thick and 4" diameter steel disk on top of the specimen. Lower the stage 1/2" and apply about 10 additional blows without changing foot pressure. This additional leveling aids in more consistent exudation readings.

4.7 Granular materials are very difficult to handle without damage and require a paper basket to keep the specimen intact. Baskets prevent the specimen from falling out of the mold and from crumbling when transferred from the mold to the stabilometer. When a basket is used, place the specimen in four approximately equal layers in a mold before compacting by use of the portable trough. Tamp each layer lightly with about ten strokes of the weighted brass rod to arrange the coarser particles in the mold. Apply 140 blows to the specimen with compactor maintaining 100 psi foot pressure. Then remove mold from compactor keeping it upright so specimen will not fall out.
(To fabricate paper basket, see Appendix A, Method of Fabricating Paper Baskets)

4.8 Record test data into form ITD 882 “R-value Worksheet”

5. Precautions

5.1 It is important that the operator feed the material into the mold uniformly. Differences in the compactive effort can cause variation in the exudation pressures.

5.2 Even distribution of the coarse aggregates throughout the length of the feeder trough is important in order to avoid segregation in the compacted specimen. The material should be evened out and leveled manually with the fingers or spatula along the trough before starting the feeding operations.

5.3 The decision whether to use baskets on a given material must be based on experience. They should not be used if they are not needed. If baskets are not used and the specimen breaks up while being transferred into the stabilometer, the fact may not be apparent at the time, but it will result in both excessive stabilometer pressure readings and excessive displacement readings. Both of these errors tend to lower the R-value, and a group of four tests will be erratic with respect to one another. When this happens, the test must be repeated using baskets.

5.4 Care must be taken to select the proper amount of material to produce a 2.5" pat. No material shall be removed from the trough or mold in order to produce the correct height.

5.5 Precautions should be taken to avoid any drying of material during mixing, in the feed trough or in the mold.

6. Hazards

Caution must be used to make certain nothing comes in contact with the compactor foot while it is in operation. A finger caught between the edge of the mold and the compactor foot will receive serious injury.

PART III. METHOD OF DETERMINATION OF EXUDATION PRESSURE

1. Scope

This part of the method describes the procedure used to determine the pressure required to exude water from the compacted specimen. This pressure is the "Exudation Pressure" for the specimen at that particular moisture content.

2. Apparatus

2.1 Compression testing machine, 10,000 lb. minimum capacity with solid head (Figure 3). If head is spherically seated, use proper shims to lock it in such a manner that the contact face is fixed firmly in a horizontal plane.
2.2 Perforated phosphor-bronze disks, 4" diameter and 28 gage.
2.3 Moisture exudation device (Figure 4).
2.4 Press. A level equipped with a 4" diameter foot.
2.5 Filter paper. Smooth type, 4" diameter BKH qualitative, Catalog No. 28310, or equivalent.
2.6 Height gage.
2.7 Follower ram, 4" outside diameter and 6" height.
2.8 Supply of 4" diameter manila disks.

3. Sample

The specimens as prepared in Part II.

4. Procedure

4.1 Place perforated phosphor-bronze disk directly on tamped surface of specimen in mold and place a single piece of filter paper on the disk.

4.2 Invert mold with specimen so that filter paper is on the bottom, and place mold on the moisture exudation device. Place 4" manila disk on top surface. Then push specimen through to other end with press. It is very important that the mold be centered on the exudation device; this is accomplished by viewing in the mirror and adjusting as necessary. In the case of a basket specimen, do not invert the sample prior to placing on the exudation device; simply center a filter paper on the contact plate and wipe moisture from bronze disk. Then place mold containing basket and material on filter paper.

4.3 Insert the follower ram in top of the mold on the specimen. Attach battery clamp to mold and place exudation device with mold in the testing machine and center to ensure even loading.

4.4 Use the testing machine to apply an increasing load at the rate of 2,000 lb. per minute until there are lights on in five of the six sections of the moisture exudation indicator device (Figure 5). Note and record the load at this point. However, if free moisture becomes visible around the bottom of the mold, covering an area approximately 2" in length (which should touch four contact points) and there are lights on in at least three of the six sections, record the load at that moment in lieu of waiting for five sections**.**

4.5 Discard the specimen if the exudation load does not fall within the required range. A low of 1,000 lb and a high of 5,000 lb may be accepted if necessary.

4.6 Leave the mold with follower in place on the exudation device and then place the height gage over mold and follower. Allow dial to come to rest, then read and record. A constant of 2" is understood; that is, if the dial was to read 0.460, the actual height would be 2+0.460 = 2.460".

4.7 Record all test data in form ITD 899

4.7 Next, remove height gage, follower, manila paper, bronze disk, and filter paper and weigh the mold with specimen and record. In the cases where a basket is used, the weight of the basket must be taken into consideration and accounted for by adding its weight to the weight on the mold. The basket's average weight is about 33 g.

5. Precautions

5.1 When the exudation contact plate becomes worn or grooved and the contact points become raised or depressed, the plate should be machined to a plane surface or replaced.

5.2 The operator must wipe the contact plate dry between tests, since any moisture remaining will prematurely dampen the new filter paper and cause erroneous exudation pressure results.

5.3 The height gage must be checked and reset daily to ensure correct readings.

5.4 Wipe plate of basket prior to contact with filter paper.

6. Notes

6.1 Occasionally material from exceptionally heavy clay test specimens will extrude from under the mold and around the follower ram during the loading operation. Yet, when the 5,000 lb load point is reached, less than five sections are lit. When this occurs, the soil is of very poor quality and should be reported as having R-value less than 5.

6.2 There are many cases where high quality materials of a gravelly, sandy or silty nature will have exudation pressures that are extremely sensitive to slight changes in moisture content. Very often these pressures will appear erratic and out-of-step with the sequence of moistures. However, these materials generally exhibit uniform R-values having small variation throughout the entire range of exudation pressures and moisture contents. The R-value versus exudation curve is drawn as an average value in these cases.

PART IV. METHOD OF DETERMINATION OF EXPANSION PRESSURE

1. Scope

The expansion test is used to determine the amount of ballast required to prevent a reduction in density of a soil due to expansion when the soil becomes saturated.

2. Apparatus

2.1 Swell frames (Figure 6)
2.2 Micrometer dial calibrated to 0.0001" mounted on a tripod designed to fit the swell frame.
2.3 Proving ring for adjusting swell frames
2.4 Perforated disks with screw stems.
2.5 5/16" open-end wrench.

3. Sample

The samples are the soil specimens as removed from the exudation device. Each specimen should be allowed to rebound for at least 30 minutes after the exudation test before assembling in the swell frame.

4. Procedure

4.1 Place micrometer dial in position on swell frame. Using the 5/16" open-end wrench, adjust the swell frame for an initial reading of minus (-) 0.0016" (the dial will read 0.0084"). You may notice a variance in the dial as there is a slight amount of play as the dial sits on the swell frame, so for the sake of uniformity, the dial is placed as far to the right as possible. The swell frames should be checked periodically with the proving ring and adjusted.

4.2 Place one of the perforated plates with screw stems on top of specimen. Place the mold in the swell frame, making sure the base of the frame is dry and free of dirt and sand. After the 30-minute rebound period, adjust the screw stem on the disk until the micrometer dial reads 0.0000" with the dial placed as far to the right as possible. This is equivalent to a surcharge pressure of 0.5 psi. It is necessary that the pointed end on the screw stem makes contact with the elastic steel bar exactly in the center. This can be accomplished by visually sighting it in from two different angles. Add water to a depth of approximately 3/4" above the perforated disk and allow the mold to remain in the swell frame overnight or a period of at least 16 hours. Do not readjust the screw stem after adding the water to the mold.

4.3 After the 16-hour waiting period, read the deflection of the steel bar by means of the micrometer dial and record on the work sheet. It is again important that the dial be pushed as far to the right as possible. The amount of drainage should also be indicated by the presence or absence of free water at the base of the mold. No drainage at all is indicated by a zero. Slight drainage will be denoted by "SL" and is recognized by a small amount of free water at the base of the mold. Moderate drainage will be "MOD" and is recognized by free water at the base of the mold and a definite drop of the water level inside the mold. Free drainage, denoted as "FD", will be completely void of standing water inside the mold. If the specimen is free draining, a little water must be added and allowed to percolate through in case the sample has dried out considerably.

4.4 The next step is to remove the mold from the swell frame, drain off the remaining water, and replace the perforated disk with a 4" Manila paper disk. Save the specimen for the R-value test.

4.5 Determine the expansion pressure in psi by multiplying the dial reading by 0.0308. Record the Expansion pressures into form ITD 899

PART V. METHOD OF DETERMINATION OF RESISTENCE R-VALUE BY HVEEM STABILOMETER

1. Scope

This method covers the procedure for determining the Resistance R-value of compacted soils or aggregates.

2. Apparatus

2.1 Hveem stabilometer (Figure 7) complete with standard metal specimen and follower .
2.2 Compression testing machine with spherically seated head.
2.3 Press. A lever equipped with a 4" diameter foot to push soil specimens from mold into stabilometer.
2.4 Dial on testing machine to measure head speed.
2.5 Stop watch.
2.6 Drying oven thermostatically controlled to maintain a temperature of 220-230°F.

3. Sample

The specimens as removed from the swell test frames.

4. Procedure

The correct volumetric adjustment of the air cell in the hydraulic chamber of the stabilometer is necessary in order to establish standardized horizontal pressure and displacement readings. The following is an outline of this calibration procedure.

4.1 Adjust the bronze nut on the stabilometer base so that the top of the stage is 3" below the bottom of the upper tapered ring. Perform all tests at this setting. The object is to have the entire briquette surface in contact with the diaphragm and any surplus diaphragm above the sample restrained by the follower.

4.2 Put standard metal specimen (4" diameter steel tube) in place in the stabilometer. Seat it firmly on the stage and by holding it in place with either the hand or a confining load of 100 lb. in the testing machine, turn the pump to cause a pressure of exactly 5.0 psi on the stabilometer gage. Adjust the turn indicator dial to zero. Turn pump handle at an approximate rate of two turns per second until the stabilometer dial reads 100 psi. The turns indicator dial should read 2.00 ± 0.05 turns. If it does not, the air in the cell must be adjusted. Remove or add air by means of the valve and repeat the displacement measurement after each air change until the proper number of turns is obtained. This initial displacement should be checked after each 3 or 4 specimens have been run through the stabilometer.

4.3 Place the mold containing the soil specimen on the stabilometer and push the specimen into the stabilometer using the press. The displacement pump should be backed off a sufficient number of turns to ensure no friction between the specimen and the diaphragm wall. Be certain free diaphragm is exposed above the top edge of specimen. All free diaphragm surface must be in contact with follower. Place the follower on top of the specimen and put the stabilometer in the testing machine with spherically seated head. Lower the testing machine head until it just engages the follower, but does not apply any load to the specimen.

4.4 Apply an initial reading of 5.0 psi on the stabilometer gage with the displacement pump. Then start the testing machine and adjust for a head speed of 0.05" per minute. The head speed must be checked and may need readjusting while the test is being made.

4.5 Record the stabilometer gage readings at loads of 500, 1,000, 1,500, and 2,000 lb, respectively, on the testing machine gage. In the case of a very expansive soil, a reading somewhat over 140 psi on the stabilometer gage at 2,000 lb. load may be encountered. In any case where 140 psi is reached before the 2,000 lb. is applied, do not continue to the 2,000 lb. point. Simply record the pressure at the 2,000 lb. load level as 140+ psi.

4.6 Vertical loading by the testing machine must cease at 2,000 lb. and the load must immediately be reduced to 1,000 lb. Turn the displacement pump so that the stabilometer gage reading is reduced to 5.0 psi. This will result in a further reduction in the applied testing machine load, which is normal and should be ignored. Set the displacement dial indicator to zero and turn the displacement pump handle to the right at a speed of 2 turns per second until the stabilometer gage reads 100 psi. During this operation, the applied testing machine load will increase and in some cases exceed the initial 1,000 lb. load. As before, these changes in testing machine loadings are normal and should be ignored.

4.7 Record the number of turns indicated on the dial as the displacement of the specimen. The turn indicator dial reads in 0.001" and each 0.1" is equal to one turn. Thus a net reading of 0.250" indicates that 2.50 turns were made and should be recorded as such on form ITD 882 “R Value Worksheet”.

4.8 Remove the stabilometer from the testing machine and release the lateral pressure. Then remove the follower and the specimen from the stabilometer.

4.9 The Resistance R-value is computed from the following equation:

$$R = 100 - \frac{100}{\left[\left(\frac{2.5}{D}\right)\left(\frac{Pv}{Ph} - 1\right)\right] + 1}$$

Where: R = Resistance R-value
D = Turn Displacement
Pv = 160 psi (Vertical pressure)
Ph = Horizontal pressure, psi (at vertical pressure of 160 psi)

This value may also be taken from the chart shown in Figure 8. Another chart is shown in Figure 9 that can be used to correct the R-value of any specimen that must be used but exceed the height limits of 2.45" - 2.55". These R-values are then plotted against the corresponding exudation pressures and connected with a smooth curve in form ITD 882.

Determine the point where the curve crosses the 2,500 lb. exudation load line (200 psi exudation pressure) and record it as the Resistance R-value for the tested material (see Example in Figure 10).

PART VI. METHOD OF CALCULATING THE DENSITIES OF TEST SPECIMENS

1. Scope

This part of the test method covers the procedure for calculating the densities of R-value test specimens.

2. Sample

The measurements of height and weight of the test specimen necessary for the density determination are made immediately after the determination of exudation pressure of R-value test specimens according to Part III of this test method and they are recorded into form ITD 899 “Preliminary Soils Worksheet” .

3. Procedure

3.1 A moisture sample of approximately 500 g is taken from the original 13 lb. sample, as explained in Part I, and the data entered into form ITD 882 “R Value Worksheet”. The Moisture Content or Percent Water is computed by the following equation:

$$\% \text{ Water} = \frac{Wt.of\ Water\ (g)}{Wt.of\ Dry\ Soil\ (g)}\ x\ 100$$

3.2 The Weight of Water is determined as follow:

$$\text{Dry Weight (g)} = \frac{Original\ Weight\ (wet,g)}{1+\frac{\%\,Water}{100}}$$

Weight of Water (g) = Original Weight (g) – Dry Weight (g)

The Weight of Water is carried over to the line labeled "Wt. of Water" and entered for each specimen in form ITD 882. This is then added to the figures on the next line labeled "Water Added" giving the Total Water for each specimen. The Total Percent of Water is calculated as follow:

$$\% \text{ Water} = \frac{Total\ Water\ (g)}{Dry\ Weight\ (g)}\ x\ 100$$

3.3 The densities of the specimen are then computed from the following equations:

$$\text{Wet Density (pcf)} = \frac{Net\ Weight\ of\ Soil,Wet\ (g)}{Height\ (Inch)}\ x\ 100$$

$$\text{Dry Density (pcf)} = \frac{Wet\ Density\ (pcf)}{1+\frac{\%\,Water}{100}}$$

APPENDIX A

METHOD OF FABRICATING PAPER BASKETS FOR
R-VALUE SPECIMENS

1. Scope

This method covers the procedure for fabricating paper baskets that are used in Test Methods No. California 301 and 304.

2. Procedure

2.1 Apparatus

Basket making device consisting of a 3 7/8" diameter cylindrical wooden block and a 1/2" masking tape dispenser (see Figure 11).

2.2 Materials

2.2.1 Strips of notched paper: 60 lb. brown Kraft paper 2 1/2" x 13 3/8" with slots 1 7/8" in length and 3/4" apart down the center of the strip (see Figure 12).

2.2.2 4" diameter phosphor-bronze perforated exudation pressure disks.

2.2.3 1/2" width masking tape.

2.3 Fabrication Procedure

2.3.1 Take a piece of slotted paper and fold around the cylindrical wooden block, hooking the slotted ends together. See photos B and C of Figure 11.

2.3.2 Using four strips of 1/2" masking tape, tape phosphor-bronze disk to the paper so that the holes in the disk are not obscured in the process. See photos D and E of Figure 11.

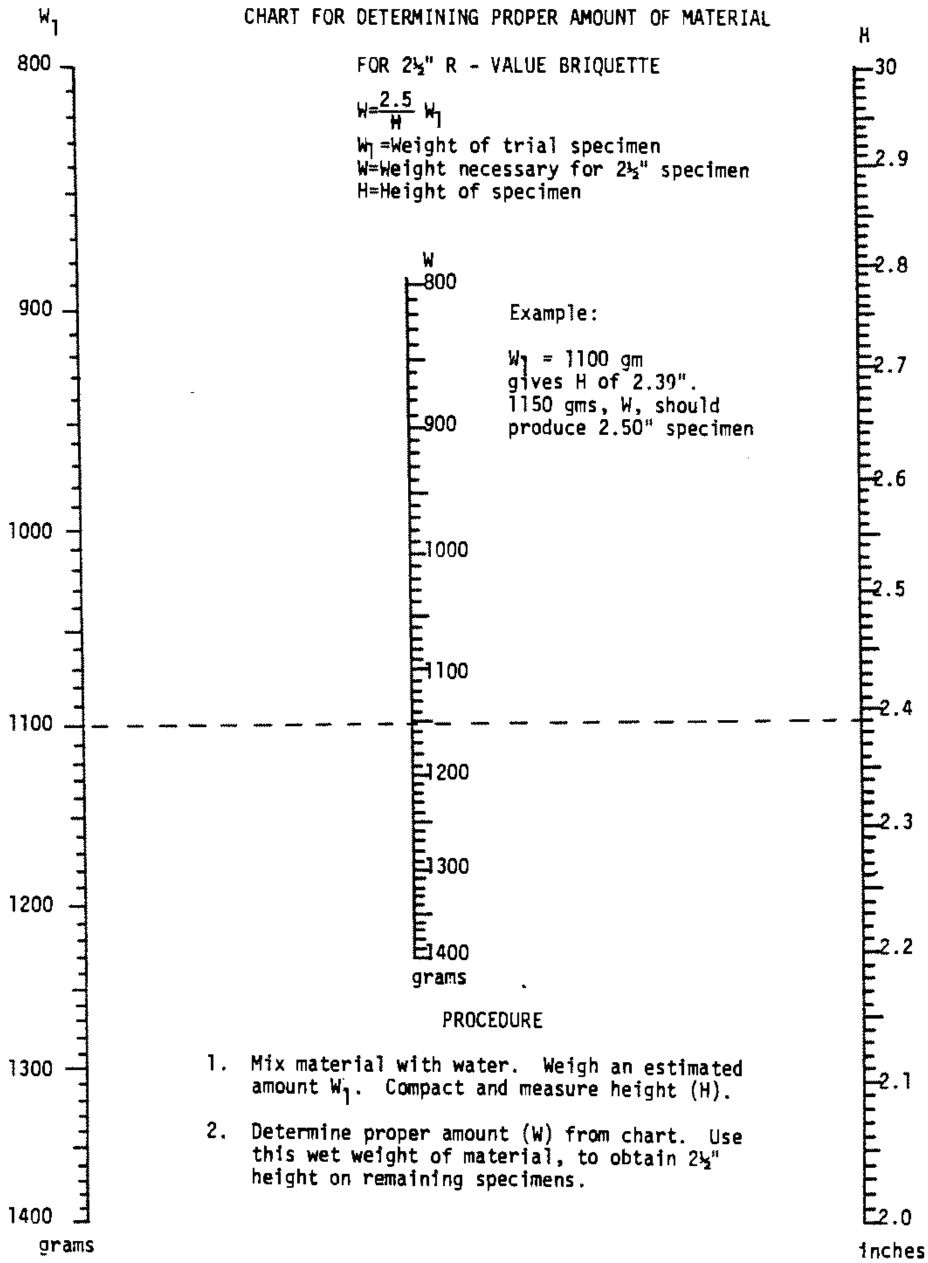


CHART FOR DETERMINING PROPER AMOUNT OF MATERIAL
FOR 2½" R - VALUE BRIQUETTE
$W = \frac{2.5}{H} W_1$
W_1 =Weight of trial specimen
W=Weight necessary for 2½" specimen
H=Height of specimen
Example:
W_1 = 1100 gm
gives H of 2.39".
1150 gms, W, should
produce 2.50" specimen
PROCEDURE
1. Mix material with water. Weigh an estimated amount W_1. Compact and measure height (H).
2. Determine proper amount (W) from chart. Use this wet weight of material, to obtain 2½" height on remaining specimens.
W_1
800
900
1000
1100
1200
1300
1400
grams
W
800
900
1000
1100
1200
1300
1400
grams
H
30
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
inches

FIGURE 1

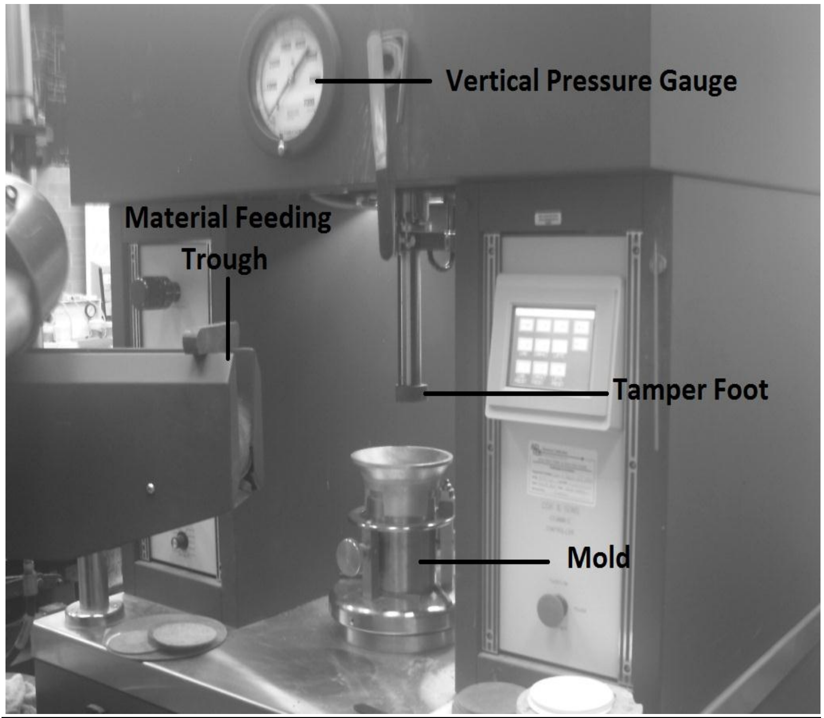


FIGURE 2: KNEADING COMPACTOR

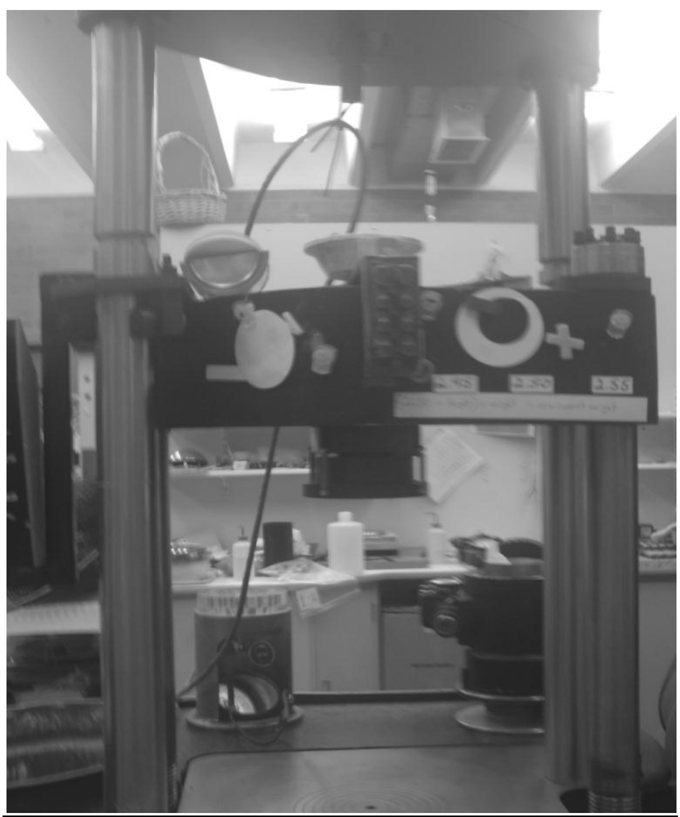


FIGURE 3: COMPRESSION TESTING MACHINE

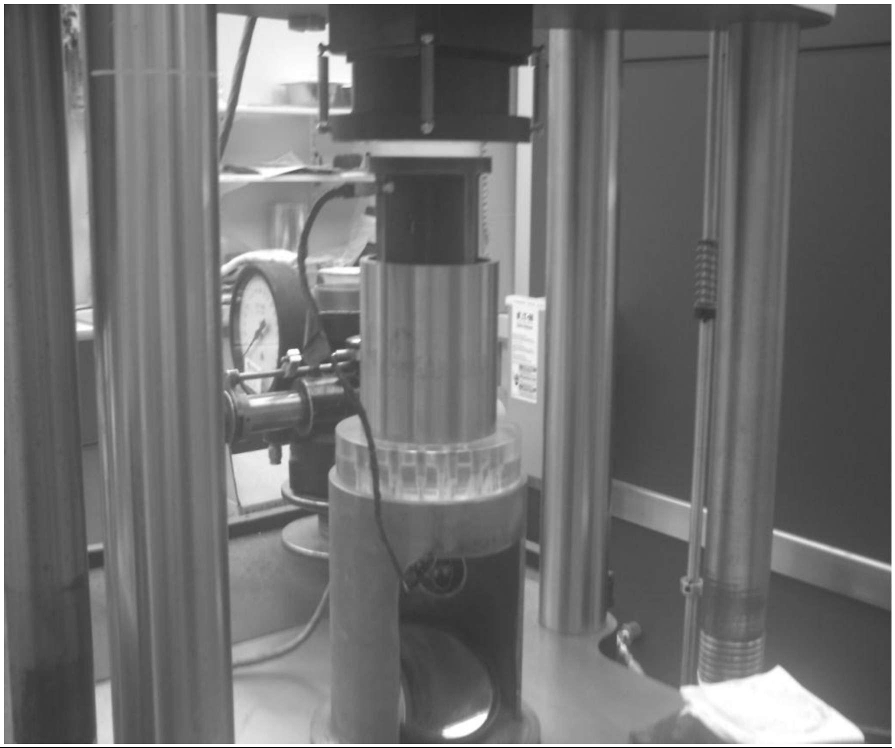


FIGURE 4: MOISTURE EXUDATION DEVICE

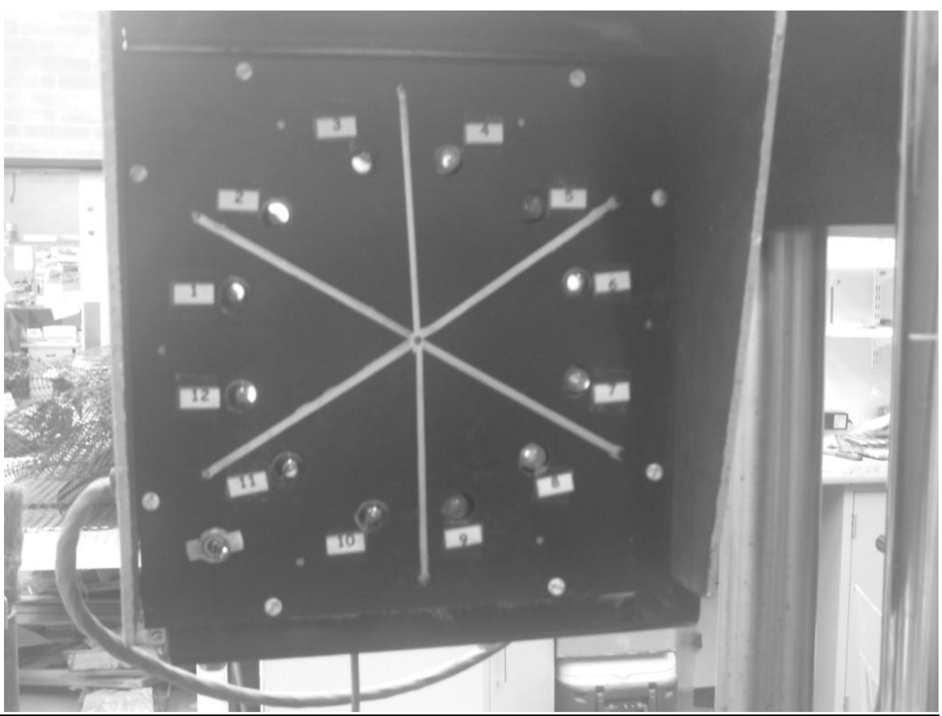


FIGURE 5: MOISTURE EXUDATION INDICATOR DEVICE WITH 6 LIGHT SECTIONS

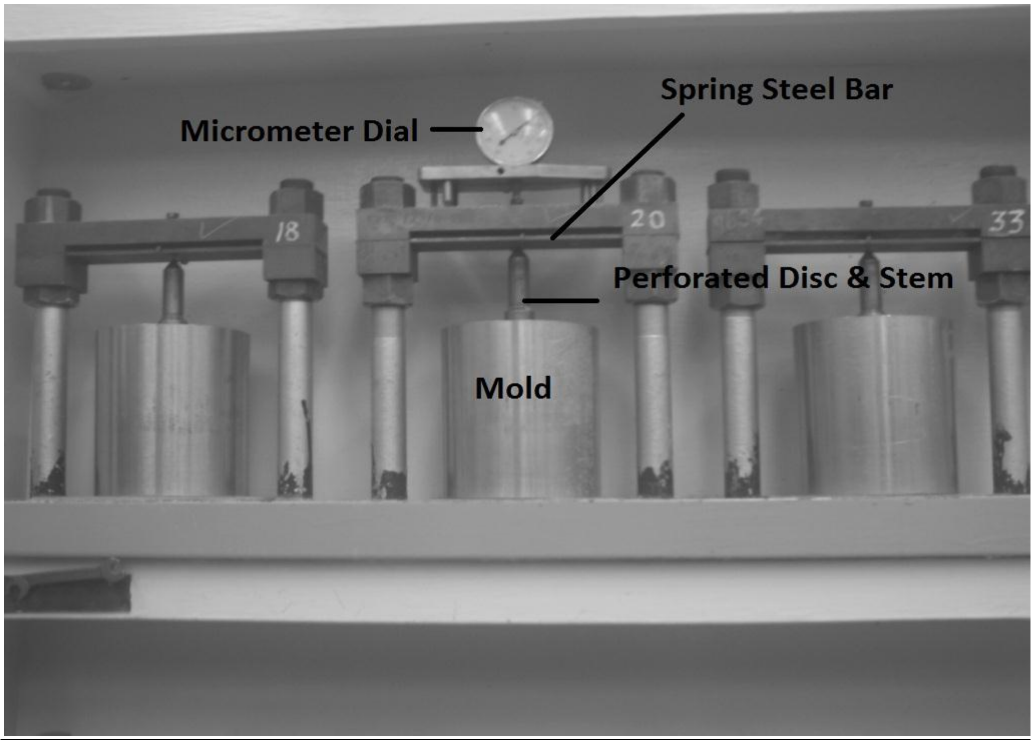


FIGURE 6: SWELL FRAMES FOR MEASURING EXPANSION PRESSURE

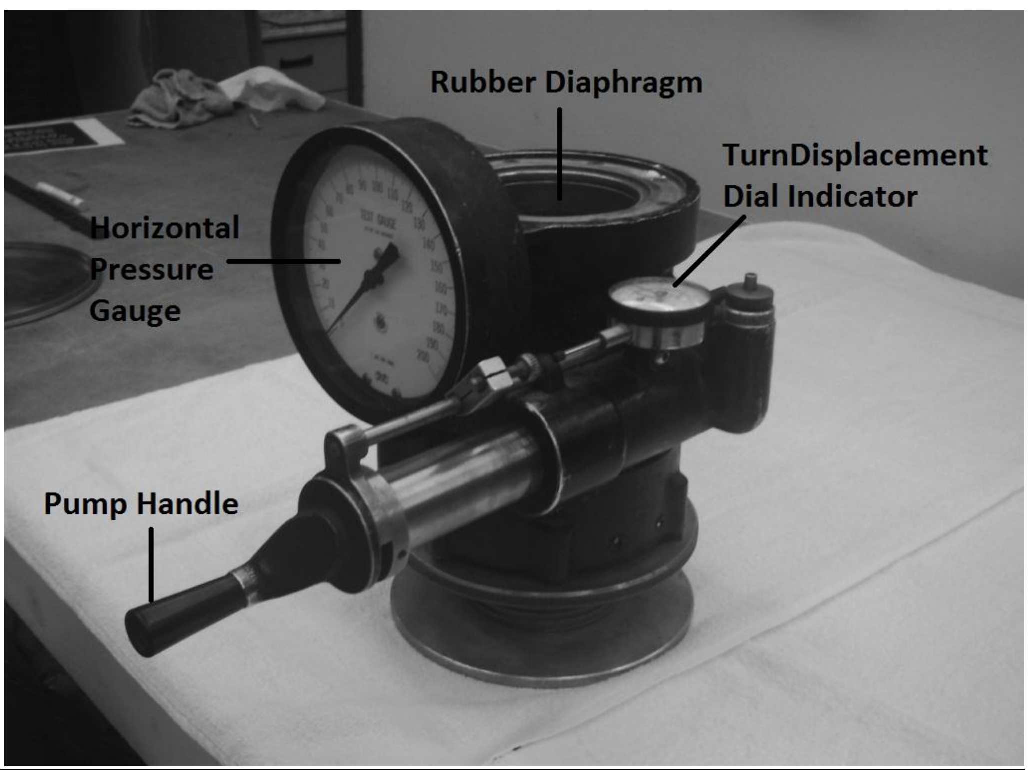
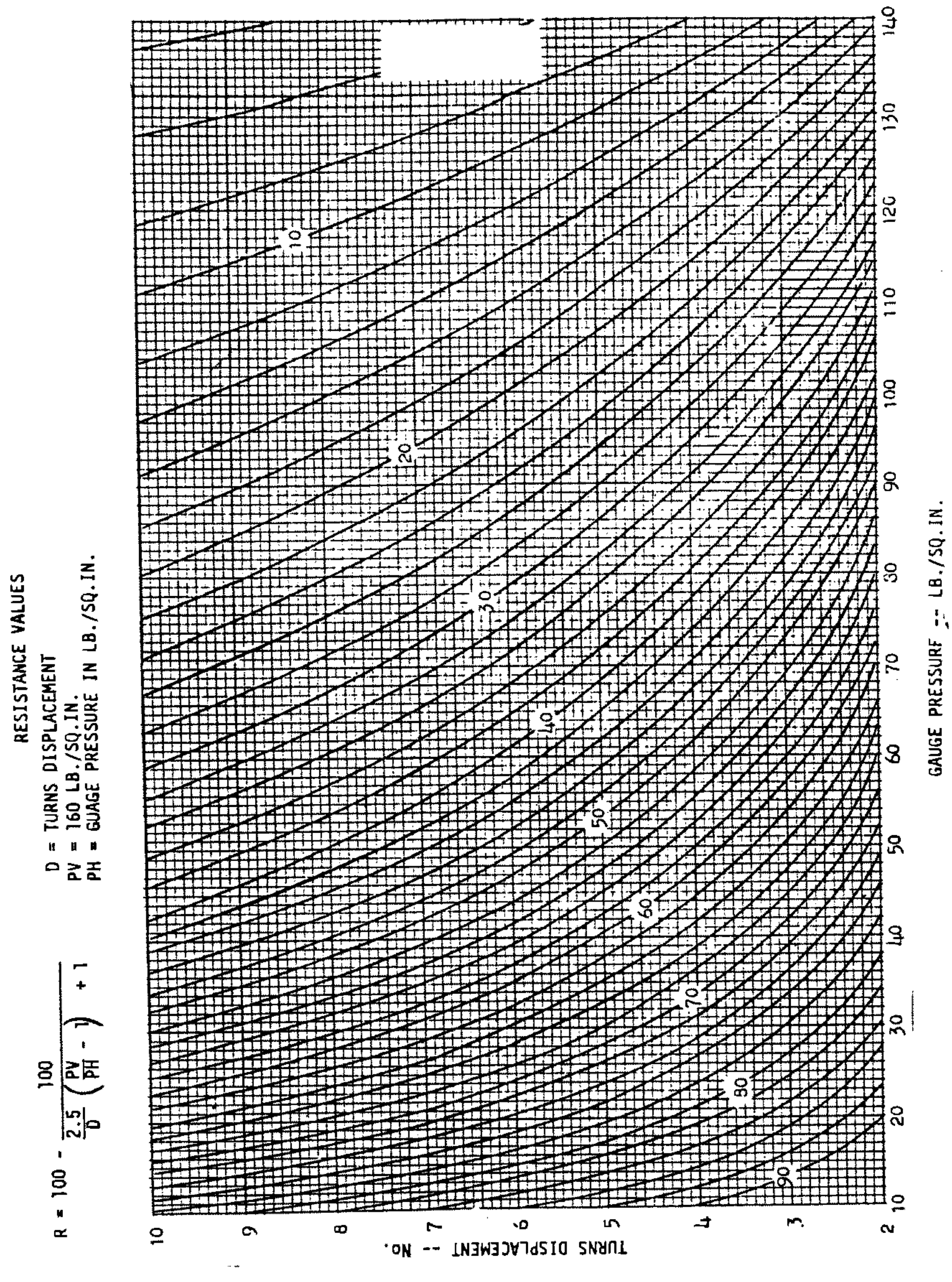


FIGURE 7: HVEEM STABILOMETER



<ins>FIGURE 8: CHART FOR DETERMINING RESISTANCE R-VALUE</ins>

CHART FOR CORRECTING R-VALUES TO SPECIMEN HEIGHT OF 2.50"

HEIGHT CORRECTION SHOULD BE MADE USING THE CHART BELOW.

NOTE: NO CORRECTION FOR SPECIMEN HEIGHTS BETWEEN 2.45" AND 2.55". INTERPOLATE R-VALUE CORRECTIONS FOR OTHER HEIGHTS.

EXAMPLE: OVERALL HEIGHT OF 2.65"
R-VALUE (UNCORRECTED) = 50
R-VALUE (CORRECTED) = 54

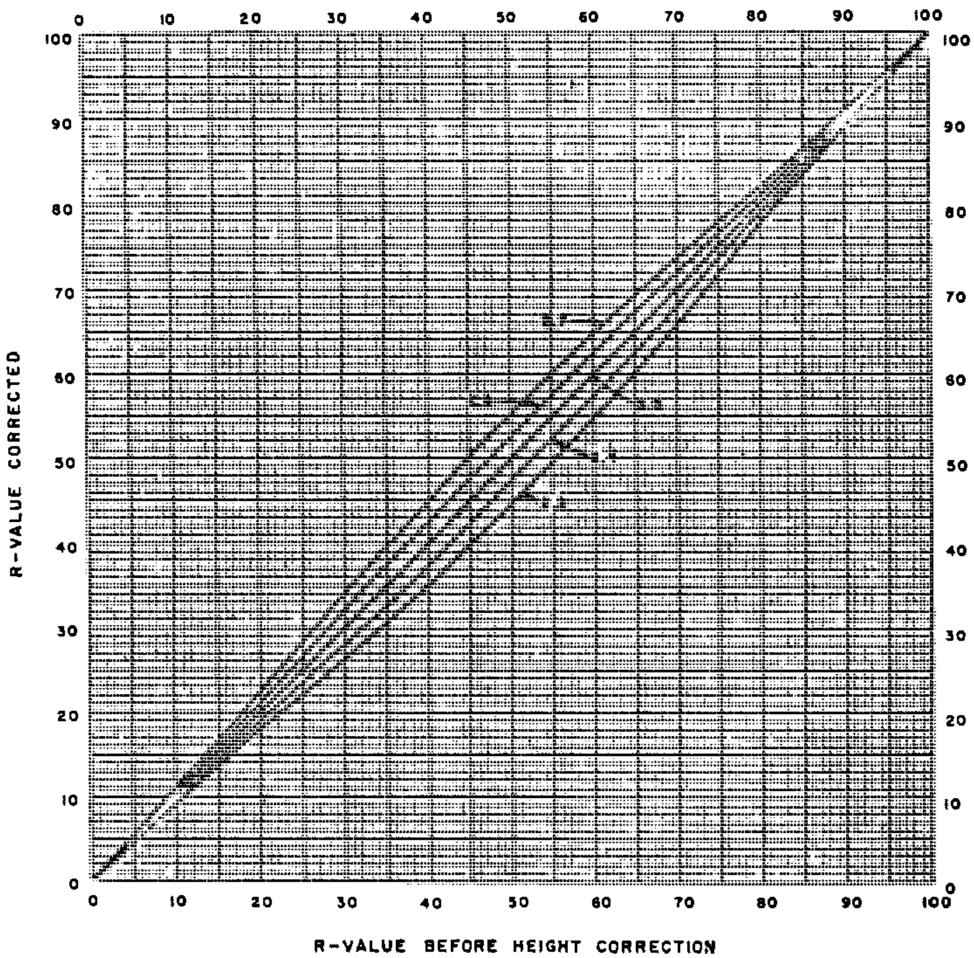


FIGURE 9: CHART FOR CORRECTING R-VALUE TO SPECIMEN HEIGHT OF 2.5”

ITD-882 2-01

R-VALUE WORKSHEET

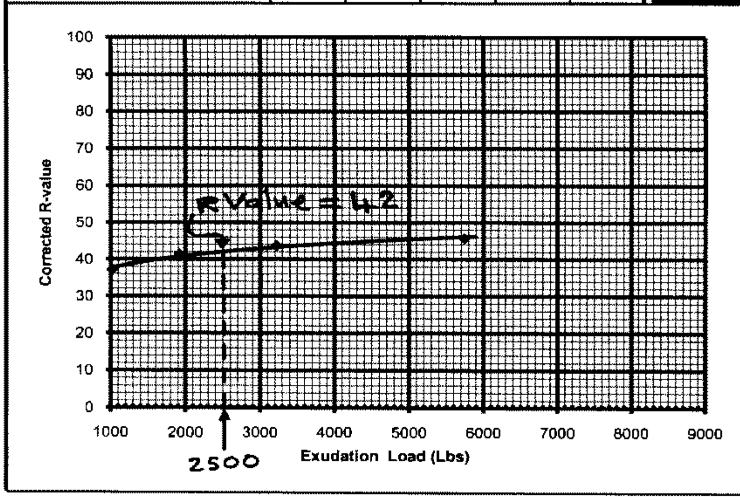
Lab Number : ____________
Project No. ____________
Key Number : ____________

TRIAL	A	B	C	D	E
MOLD NUMBER	6	7	9	8	
ORIGINAL WEIGHT (grams)	750.6	800.7	790.6	770.9	
WEIGHT OF WATER (grams)	157	167	165	161	
WATER ADDED (grams)	75.01	64.11	58.79	49.89	
TOTAL WATER (grams)	232	231	224	211	
% WATER	39.0%	36.5%	35.8%	34.5%	
WT. OF MOLD + SOIL (grams)	2917.7	2953.7	2948.2	2920.9	
WT. OF MOLD + BASKET (grams)	2102.6	2094	2104.3	2105	
NET WT. OF SOIL, WET (grams)	815.1	859.7	843.9	815.9	
HEIGHT, INCHES	2.443	2.609	2.525	2.39	
WET DENSITY - Lbs/Cu.Ft	101.1	99.8	101.3	103.4	
DRY DENSITY - Lbs/Cu.Ft	72.7	73.2	74.6	76.9	
STABILITY Ph. 500	19	15	12	13	
Ph. 1000	33	26	23	24	
Ph. 1500	50	41	36	35	
Ph. 2000	72	62	53	49	
DISPLACEMENT	4.9	6.24	6.68	6.08	
"R" VALUE	38	39	43	48	
"R" VALUE - Corrected	37	41	44	46	
EXUDATION PRESS, LBS	1020	1917	3225	5747	
DRAINAGE	SL	SL	SL	SL	
GAGE READS	18	23	50	41	
EXPANSION PRESS. PSI	0.55	0.71	1.54	1.26	

Coarse R-value Make up Calculations					
Weight Of Sample					Lbs
Sieve Size	Corr. Accum. Lbs	% Passing	% Each Size	Grams Each Size	Accum. Grams
3/4 inch					
1/2 inch					
3/8 inch					
# 4					
Minus # 4					

Make Up Moisture Content Calculations			
To Achive		% Moisture, Add Grams Of Water	

Comments:



CAN NUMBER	M-2
WT. OF CAN + WET SOIL, GRAMS	497.81
WT. OF CAN + DRY SOIL, GRAMS	402.86
WT. OF WATER, GRAMS	94.95
WT. OF CAN, GRAMS	42.63
WT. OF DRY SOIL, GRAMS	360.23
% WATER	26.4%

TRIAL >>>>>	A	B	C
ORIGINAL WT (gram	750.6	800.7	790.6
DRY WEIGHT (grams	594	634	626
WATER (grams)	157	167	165

TRIAL >>>>>>>>>>>	D	E
ORIGINAL WT (gram	770.9	
DRY WEIGHT (grams	610	
WATER (grams)	161	

SOIL DATA	
TRAFFIC INDEX	
"R" VALUE	42
EXPANSION PRESS, PSI	
BALLAST FROM "R"	
FROM EXP. PRESSURE	

FIGURE 10: R-VALUE TEST WORKSHEET

FABRICATION PROCEDURE

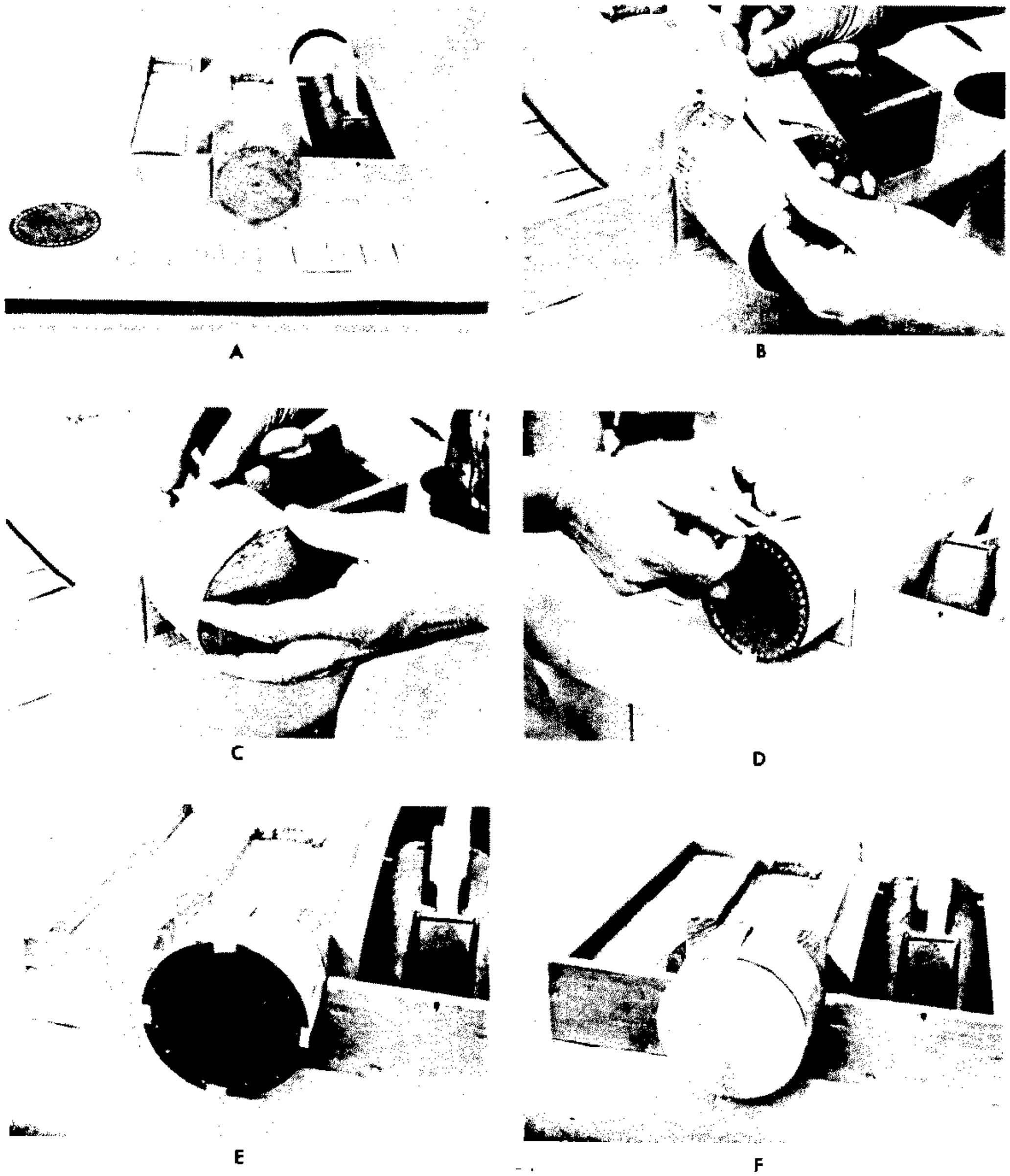


FIGURE 11: FABRICATING PAPER BASKET FOR TEST SPECIMEN

SPECIFICATIONS FOR THE SLOTTED PAPER USED IN FABRICATING PAPER BASKETS FOR STABILOMETER SPECIMENS

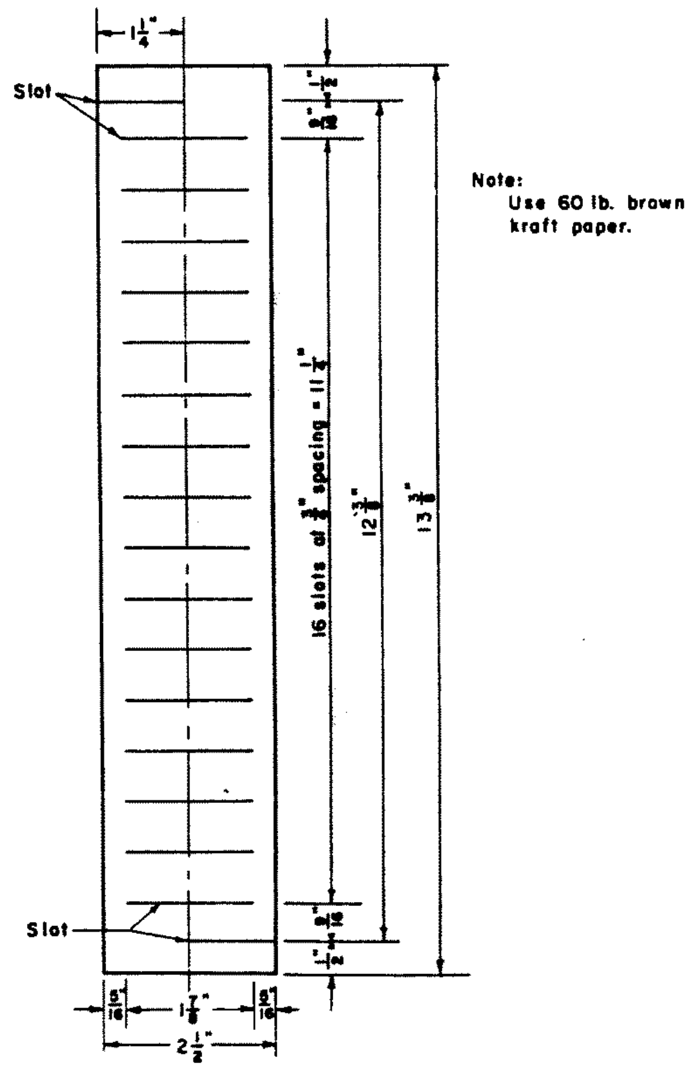


FIGURE 12: SPECIFICATIONS FOR PAPER USED TO FABRICATE BASKET

Idaho Standard Practice for

Taking Undisturbed Soil Samples for Laboratory Consolidation, Shear and Permeability Tests

Idaho IR-62-98

1 Scope

1.1 This method of sampling is designed to secure relatively undisturbed soil samples for laboratory tests. Only soils relatively free of gravel and other rock fragments are considered suitable for this type of sampling.

2 Apparatus

2.1 Mobile drill or diamond drill with standard attachments.

2.2 Clean-out device to assure a clean hole.

2.3 A 2 1/2-in. (63.5 mm) I.D. sample barrel with a supply of 1-in. (25 mm) high brass liner rings and/or a supply of 2- to 3-in. (50 to 75 mm) diameter Shelby thin-wall tubes, 18 to 36 in. (450 to 900 mm) in length with a wall thickness not greater than No. 16 (1.5 mm) gage.

3 Procedure

3.1 The boring should be cleaned out either by hand auger or air jetting to the sampling elevation. Make sure that the bottom of the boring is free of excess loose material.

3.2 With the sampling device resting on the bottom, push it into the soil by a continuous and rapid motion using the hydraulic ram on the mobile drill or diamond drill. The penetration should be approximately five (5) times the diameter of the tube. Do not push the tube farther than the length provided for the sample. The time and pressure required, when measured, should be noted.

3.2.1. If driving is required, the number of blows, driving weight, drop, and penetration should be recorded. Heavy driving weights are preferable to light driving weights because they cause less sample disturbance.

3.3 Before pulling the sample, turn it two (2) revolutions by hand to shear it on the bottom. Pull the sample tube to the surface.

3.4 After pulling the sample, measure and record the length of sample in the tube and also the length penetrated. If the ring-lined sampler is used, select a central portion of the sample and place it in the watertight containers. If the Shelby tube is used, discard the disturbed soil in the upper end. Ream the lower end to a depth of at least 1 in. (25 mm), seal both ends with wax or other approved methods, and secure with masking tape.

3.5 Containers and/or tubes should be clearly labeled as to project, boring number and location, sample number, depth taken, date taken, and personnel.

3.6 Samples should be taken to supplement in-place vane shear tests or standard penetration tests. The number taken is left to the discretion of the investigator. Generally, enough samples should be taken to provide information on each soil type encountered.

3.7 Samples should not be shipped to the Central Laboratory by common carrier, but should be delivered by state vehicle. Sedans are preferred, as the sample can be laid on the seat and cushioned. Deliver as soon as possible. No storage is permitted. Protection should be provided for heat and cold.

3.8 Dropped samples or frozen samples are of no value. Thus, precautions must be taken to eliminate mishandling.

4 Records

4.1 The following information should be taken in the field and transmitted with the samples (see also instructions for "Preparation of Field Logs," Idaho T 95).

4.1.1. Date of boring and project identification.

4.1.2. Location of boring, including offset distance.

4.1.3. Boring number.

4.1.4. Collar elevation.

4.1.5. Log of the boring.

4.1.6. Location of the samples taken in profile.

4.1.7. Water data.

4.2 Information regarding the present topography and landform, as well as dimensions of the proposed structure or embankment, should be noted. This, plus the estimated weight per ft^3 (m^3) of a proposed embankment, should be recorded and the information supplied to the Central Materials Laboratory with the undisturbed sample.

Idaho Standard Practice for

Calibrating Torque Wrenches, Tightening and Testing Bolt Tension

Idaho IR-12-07

1 Scope

1.1 This method is intended to provide a standard procedure for the calibration of torque wrenches

2 Referenced Documents

2.2 *AASHTO Standards:*

T-67 Standard Method of Test for Standard Practices for Force Verification of Testing Machines

2.3 *ASTM Standards:*

E4-03 Standard Practices for Force Verification of Testing Machines

3 Procedure

3.1 Before proceeding with calibration, assure that the tension measuring device has been calibrated by an approved testing agency within the last year in accordance with AASHTO T-67/ASTM E-4.

Prior to each day's activities, verify the calibration of the wrench or wrenches being used. If a parameter is found to be out of calibration, adjust the wrench to assure the parameter is within the tolerable range. Report all calibration measurements including the date, out of tolerance values, and adjusted values.

4 Calibration Of Torque Wrench

4.1 Clamp the calibration unit on a solid immovable mount (e.g., beam, column, etc.)

4.2 Install front plate and matching rear bolt bushing for bolt size being used

4.3 Insert bolt from bushing side; washer and nut from plate side.

4.4 Torque Control Impact Wrenches:

Run up nut with impact wrench until wrench stalls. Read the dial for pounds tension. If reading is too high or low, adjust torque setting accordingly and repeat using new bolt and nut.

4.5 Conventional Impact Wrenches:

Set wrench air line regulator at desired power value. Run up nut until it stops rotating. Again, read the dial for pounds tension. Adjust regulator as necessary until wrench delivers desired bolt-tension dial reading.

4.6 Manual Torque Wrenches:

Run up nut with wrench until reaching desired tension. Adjust ratchet release as necessary until wrench delivers desired bolt tension dial reading. For dial gage wrenches, document the dial reading to achieve the appropriate tension on the calibration unit, or adjust the dial gage if applicable.

4.7 Wrenches shall be calibrated to induce approximately 105 – 110% of the installation bolt tension listed in the ITD Standard Specifications Subsection 708.06 for the given bolt size, and in no case exceed 125% of the listed bolt tension. Acceptable calibration will consist of three (3) bolt assemblies testing within 10% of each other.

Idaho Standard Practice for

Calibrating the Skidmore-Wilhelm Torque-Wrench Calibration Unit

Idaho IR-17-98

1 Scope

1.1 This method is intended to provide a standard procedure for the calibration of the Skidmore-Wilhelm Torque-Wrench Calibration Unit (see Figure 1).

2 References

2.1 ASTM E 4, Calibration

2.2 Manufacturer's Pamphlet

3 Equipment

3.1 Testing machine with a capacity of at least as high as the Skidmore unit and calibrated to ± 1%.

3.2 Steel pressure plates (two (2) each to fit piston No. 3 and inside plate screens No. 16).

4 Procedure

4.1 Place torque-wrench calibration unit in the testing machine with the bolt plate No. 5 centered directly under the upper compression head. In centering the unit in the testing machine, make sure the steel pressure plates are in place. One (1) pressure plate fits the piston No. 3 from the back sides, making sure it clears the snap ring No. 7. The other steel pressure plate fits over bolt plate No. 5 and inside the plate screws No. 16.

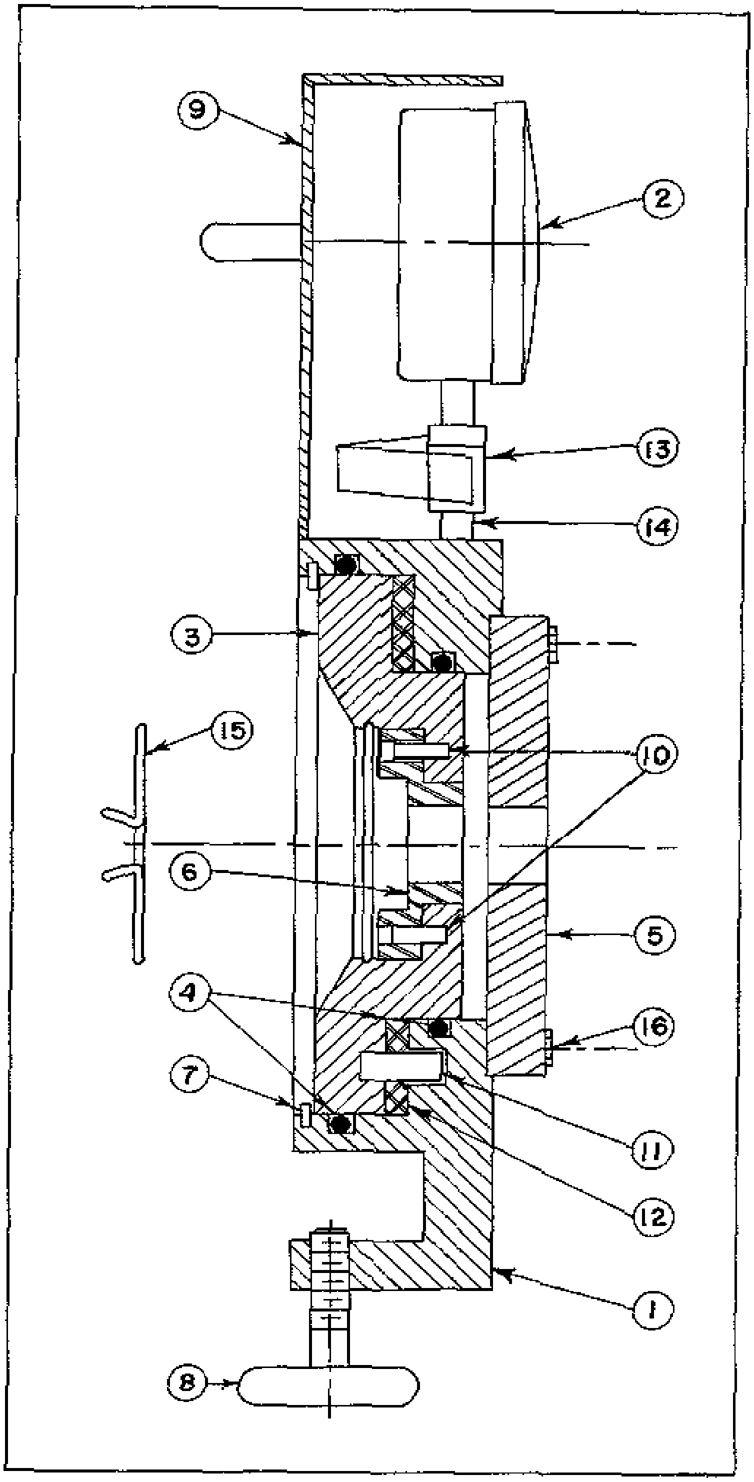
4.2 After the foregoing has been accomplished, apply pressure with the testing machine to the torque-wrench calibration unit.

Note 1: Before mating surfaces of the torque calibration unit with the testing machine heads, retain a small clearance. This clearance is then taken up with the hydraulic head of the testing machine. This step must be accomplished to prevent locking the heads of the testing machine together.

This pressure shall be at a slow, even rate so readings can be taken from both the testing machine dial and the torque-wrench calibration unit dial. This speed should not exceed 0.3125 in./minute. The Skidmore unit is read at 5,000-lb. (20 kN) increments through the total range of the Skidmore unit.

4.3 The object of this calibration procedure is to relate the pounds pressure indicated by the torque-wrench calibration unit with the pounds pressure indicated by the calibrated testing machine in exact increments of pounds to each other. If there is any deviation between the two (2) devices, the torque-wrench calibration unit must be sent to the manufacturer for repair, unless the repair is deemed minor and can be done by the laboratory accomplishing the calibrating.

Figure 1—Skidmore-Wilhelm Torque-Wrench Calibration Unit



No.	Name
1	Body
2	110,000# Gage
3	Piston
4	Set of Packing
5	Bolt Plate
6	Bolt Bushing
7	Snap Ring
8	Mounting Screw
9	Gage Guard
10	Dowel Pin (for Bushing)
11	Dowel Pin
12	S.A.E. 40 Oil (Non-Detergent)
13	Gage Saver
14	Pipe Coupling
15	Bushing Retainer
16	Plate Screw

Idaho Standard Practice for

Pavement Straightedge Procedures

Idaho IR-87-99

1 Scope

1.1 This method establishes procedures for making straightedge measurements on the riding surfaces of pavements and is intended for use with the hand-held 10 ft. (3 m) straightedge.

2 Apparatus

2.1 The apparatus shall consist of a 10 ft. (3 m) straightedge. The straightedge shall be visually straight when checked periodically against a taut fine (about 1/64 in. or 0.5 mm diameter) wire.

3 Procedure

3.1 Surface irregularities shall be measured from the straightedge to various points on the pavement surface below the straightedge. The straightedge shall be firmly supported by the pavement.

3.2 Tests for surface irregularities shall be made parallel to centerline and normal (transverse) to centerline as required to verify conformance with specified limits.

3.3 All transverse construction joints shall be measured. Make these measurements with the straightedge centered on each joint.

3.4 Individual judgement shall be exercised when taking measurements on short, steep, super-elevated sections and crowned sections of short radii such as at intersections of city streets, etc.

3.5 On bridge decks where the specifications require 90 percent of the readings to be less than 1/8 in. (3 mm), measurements shall be taken in each wheel path in continuous lines as provided in paragraph 3.2 above for the full length of the structure. In addition, at locations determined by the Engineer, straightedge measurements are to be taken perpendicular to centerline. These transverse measurements may be made either in continuous lines or as individual 10 ft. (3 m) samples at selected locations. Measure the lengths of irregularities, which are less than 1\8 in. (3 mm) below the straightedge, to the nearest 1 in. (25 mm). Add up the lengths having less than 1/8 in. (3 mm) deviation within each 10 ft. (3 m) increment, divide by the straightedge length and multiply by 100 to obtain the percentage less than 1/8 in. (3 mm). Also measure any deviations greater than 1/4 in. (5 mm) when the specification requires. Measure joints separately as provided in Paragraph 3.3 above.

Idaho Standard Method of Test for

Determining Volume of Liquids in Horizontal or Vertical Storage Tanks

Idaho IT-120-98

1 Scope

1.1 This method is used to determine the volume of liquids in horizontal and vertical storage tanks. It is usually called "sticking" the tank.

2 Purpose

2.1 The quantity of liquid materials at the beginning and end of shifts are needed to determine approximately how much material is being used each day and to compare with invoice totals at specific intervals when the tank is empty, full, etc.

3 Apparatus

3.1 A 50-foot flexible steel tape graduated in inches or tenths of feet. (A 15 m or longer flexible steel tape with markings at 0.01 m intervals.)

3.2 Graduated wooden rod made for tank measurements, if available.

3.3 Rags.

3.4 Insulated gloves (see No. 5, Safety Precautions).

3.5 Ladder, string, flashlight, etc., as found necessary.

Note 1: Many tanks have some indicator showing the height of liquid in the tank. This indicator may be a glass sight gauge; a permanently installed metal ladder gauge inside, visible from the top or through windows; a float with a pulley and indication on the outside; or other method. In case of doubt about the accuracy of these indicators, they should be calibrated using the data in this Test Method.

4 Test Procedure

4.1 Horizontal Tanks

The volume of the tank must be known or calculated as follows.

Determine the length and the diameter of the tank using calculated inside measurements. Calculate the volume:

4.1.1 <u>English</u>

$$V(\text{gallons}) = \frac{\pi D^2}{4} \times L \times 7.48$$ [D & L are expressed in feet and tenths of feet]

4.1.2 Metric

$$V(m^3) = \frac{\pi D^2}{4} \times L$$ [D & L are expressed in meters to the nearest hundredth]

4.1.3 Measure the depth of the liquid in the tank by use of the "stick" or a weighted tape. Divide this depth by the diameter of the tank and multiply by 100 to get the percent depth filled. Using this percent figure from Table 1 at the end of this Test Method, obtain the percent of capacity. Multiply the known volume of the tank by the percent capacity just obtained and divide by 100 to give the volume of hot liquid.

4.2 Vertical Tanks

4.2.1 Measure the inside diameter of the tank. Calculate the volume per foot (meter) as follows.

English

$$V(\text{gallons}) = \frac{\pi D^2}{4} \times 7.48$$

Metric

$$V(m^3) = \frac{\pi D^2}{4}$$

4.2.2 Measure the depth of liquid (h) in feet to the nearest tenth (meters to the nearest hundredth). Calculate the volume of liquid as follows:

English

$$V(\text{gallons}) \times h = \text{Total Volume (hot)}$$

Metric

$$V(m^3) \times h = \text{Total Volume (hot)}$$

4.2.3 Convert the volume of hot liquid obtained from Paragraph 4.1.1 or 4.2.2 to standard 60°F (15.6°C) volume using standard temperature conversion charts such as Tables IV-1, 2, and 3 of the Asphalt Institute Manual Number MS-6.

4.2.4 Convert standard temperature volume in gallons (cubic meters) to English tons (metric tons) using Table 2 at the end of this Test Method.

5 Safety Precautions

5.1 Materials being sampled are usually hazardous. They may be hot (asphalt), flammable (gas, fuel oil, or solvents), caustic (lime solutions), poison (weed killers), etc., and every care must be taken to protect the person sampling. Protective clothing should be worn. Hard hats, goggles or safety glasses, insulated gloves, long-sleeved shirts, heavy shoes, and face masks, if necessary, should be used.

Table 1— Quantities for Various Depths of Cylindrical Tanks in a Horizontal Position

% Depth Filled	% of Capacity	% Depth Filled	% of Capacity	% Depth Filled	% of Capacity
1	0.20	34	30.03	67	71.16
2	0.50	35	31.19	68	72.34
3	0.90	36	32.44	69	73.52
4	1.34	37	33.66	70	74.69
5	1.87	38	34.90	71	75.93
6	2.45	39	36.14	72	77.00
7	3.07	40	37.39	73	78.14
8	3.74	41	38.64	74	79.27
9	4.45	42	39.89	75	80.39
10	5.20	43	41.14	76	81.50
11	5.98	44	42.40	77	82.60
12	6.80	45	43.66	78	83.68
13	7.64	46	44.92	79	84.74
14	8.50	47	46.19	80	85.77
15	9.40	48	47.45	81	86.77
16	10.32	49	48.73	82	87.76
17	11.27	50	50.00	83	88.73
18	12.24	51	51.27	84	89.68
19	13.23	52	52.55	85	90.60
20	14.23	53	53.81	86	91.50
21	15.26	54	55.08	87	92.36
22	16.32	55	56.34	88	93.20
23	17.40	56	57.60	89	94.02
24	18.50	57	58.86	90	94.80
25	19.61	58	60.11	91	95.55
26	20.73	59	61.36	92	96.26
27	21.86	60	62.61	93	96.93
28	23.00	61	63.86	94	97.55
29	24.07	62	65.10	95	98.13
30	25.31	63	66.34	96	98.66
31	26.48	64	67.56	97	99.10
32	27.66	65	68.81	98	99.50
33	28.84	66	69.97	99	99.80

Asphalt Institute MS-6

Table 2 — Weight and Volume Relations [60°F (15.6°C)]

			METRIC	
SP. GR.	Pounds per Gallon	Gallons per Ton	kg per m^3	m^3 per metric ton
0.855	7.119	280.9	853	1.172
60	.161	279.3	858	1.163
65	.203	277.7	863	1.158
70	.244	276.1	868	1.152
75	.286	274.5	873	1.145
80	.328	272.9	878	1.139
85	.369	271.4	883	1.133
90	.411	269.9	888	1.126
95	.453	268.4	893	1.120
0.900	.494	266.9	898	1.114
05	.536	265.4	903	1.107
10	.578	263.9	908	1.101
15	.620	262.5	913	1.095
20	.661	261.1	918	1.089
25	.703	259.6	923	1.083
30	.745	258.2	928	1.078
35	.786	256.9	933	1.073
40	.828	255.5	938	1.066
45	.870	254.1	943	1.060
50	.911	252.8	948	1.055
55	.953	251.5	953	1.049
60	.995	250.2	958	1.044
65	8.036	248.9	963	1.038
70	.078	247.6	968	1.033
75	.120	246.3	973	1.028
80	.162	245.0	978	1.022
85	.203	243.8	983	1.017
90	.245	242.6	988	1.012
95	.287	241.4	993	1.007

Page 1 of 2

Table 2 — Weight and Volume Relations [60°F (15.6°C)] (Contd)

	ENGLISH		METRIC	
SP. GR.	Pounds per Gallon	Gallons per Ton	kg per m^3	m^3 per metric ton
1.000	8.328	240.2	998	1.002
05	.370	239.0	1003	0.997
10	.412	237.8	1008	0.992
15	.453	236.6	1013	0.987
20	.495	235.4	1018	0.982
25	.537	234.3	1023	0.977
30	.578	233.1	1028	0.972
35	.620	232.0	1033	0.968
40	.662	230.9	1038	0.963
45	.704	229.8	1043	0.959
50	.745	228.7	1048	0.954
55	.787	227.6	1053	0.949
60	.829	226.5	1058	0.945
65	.870	225.5	1063	0.941
70	.912	224.4	1068	0.936
75	.954	223.4	1073	0.932

Idaho Standard Practice for

Operation of the Profiler and Evaluation of Profiles

Idaho IR-140-07

1 Scope

1.1 The operation of the profiler, the procedure used for determining the Profile Index from profilograms of pavements made with the profilograph, and the procedure used to locate individual specified high points, are described in Parts I, II, III and IV respectively, in this test method.

1.2 Although both metric and English units are given in the test method, the values do not correspond identically in most cases. For example, a 100 m base length is considerably different than a 0.1 mi. base length. As another example, a "must grind" bump of 0.3 in. over 25 ft. is not identical to 8 mm over 8 m, although the ratio of length to height is 1,000 in both cases. Most metric constants have been selected to be convenient whole numbers, following the same idea used originally when the method was developed under the English system of units. For this reason, the usual English / metric conversion factors are not, in most cases, directly applicable when comparing English and metric versions of this method.

2 References

2.1 California test method number 526.

2.2 Texas test method number 1000-s.

2.3 Iowa DOT Materials I.M. number 341

PART I. OPERATION OF THE CALIFORNIA PROFILOGRAPH

3 Equipment

3.1 The California Profilograph consists of a frame 25 ft. (7.62 m) in length supported upon wheels at either end. The profile is recorded from the vertical movement of a wheel located at the frame at midpoint and is in reference to the mean elevation of the points of contact with the road surface established by the support wheels (see Figure 3). The profilogram is recorded on a scale of 1/300 longitudinally and full scale vertically.

3.1.1. Motive power may be provided manually or by the use of a propulsion unit powered with a gasoline engine attached to the center assembly.

Note 1: On some models (Ames, for example), the profile recording wheel is fixed to the frame and the frame is hinged to allow vertical movement of the wheel. Such models are acceptable provided the manufacturer furnishes satisfactory evidence that results are equivalent to the original

California design illustrated in Figure 3. This also applies to profilometers that have a profilograph output option.

4 Calibration and Operation

4.1 The instructions for assembling the profilograph are contained in a booklet accompanying each unit. Particular attention should be paid to the listed precautions.

4.2 Horizontal and vertical calibration are to be checked just prior to initial use on each project, and at such other times as may be required for verification. Adjustments or repairs shall be made if calibration standards are not met.

Horizontal calibration shall be performed by operating the profilograph over a measured test section of at least 300 ft. (100 m) in length. Divide the length of test section in feet by the length of recording in inches (nearest 0.05 in.). The result shall be 25.0 ± 0.2. [Divide the length of test section in meters by the length of recording in nearest mm (mm). The result shall be 0.300 ± 0.003.]. If out of tolerance, make adjustments and recheck.

Vertical calibration shall be performed on a relatively flat and level area. Place two (2) small objects* of different heights in the approximate range of 1/4 in. to 1 in. (5 to 25 mm) about 3 ft. (1 m) apart on the pavement surface and push the profilograph over them with the recorder operating. Place the objects on the chart and compare their heights with the spike heights. These should be visually identical [± .03 in. (0.5 mm) approximately], and if not, find the cause and correct it.

Computerized profilographs usually have built-in calibration routines for horizontal and vertical calibration. When available, use such routines instead of the procedures described above. Verify vertical calibration of computerized profilographs daily.

4.3 In operation, the profilograph must be moved at a speed no greater than a walk to eliminate as much bounce as possible. Too high a speed will result in a profilogram that is difficult to evaluate.

A tie to project stationing shall be noted on the graph approximately every 500 ft. (200 m). This may be lengthened to 1,000 ft. (400 m) when alignment is primarily straight. If stationing is not available, use mileposts, signposts with notation of legend, or other easily identifiable features. On computerized profilographs, the stationing printed on the chart is adequate, provided the profilograph is accurately calibrated.

4.4 Use a transverse guide rod fastened to the profilograph frame to assure that the profilograph is operated at a constant offset from a joint, paint stripe, or pavement edge. Record the offset and the reference feature (i.e., 1 m right of centerline joint). Keep the end of the guide rod aligned with the reference feature during the run. This is very important for repeatability on subsequent runs and to assure that areas needing grinding can be relocated. Some bumps do not cover the full pavement width and may be missed on subsequent runs unless the location of the initial run is accurately duplicated.

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*Small pieces of plywood, surveyor's stake, lath, etc.

PART II. EVALUATION OF PROFILE TRACE

5 Equipment

5.1 Use a plastic scale representing the specified pavement length at a scale of 1/300. A plastic scale for the profilograph may be obtained from the Central Materials Lab. Near the center of the scale is a blanking band 0.2 in. (5 mm) wide extending the entire length of the scale. On either side of this band are scribed lines 0.1 in. (2 mm) apart, parallel to the blanking band. These lines serve as a convenient scale to measure deviations or excursions of the graph above or below the blanking band. These are called "scallops."

6 Method of Counting

6.1 Place the plastic scale over the profile in such a way as to "blank out" as much of the profile as possible. When this is done, scallops above and below the blanking band usually will be approximately balanced (see Figure 1).

6.2 The profile trace will move from a generally horizontal position when going around super-elevated curves making it impossible to blank out the central portion of the trace without shifting the scale. When such conditions occur, the profile should be broken into short sections and the blanking band repositioned on each section while counting, as shown in the upper part of Figure 2.

6.3 Starting at the right end of the scale, measure and total the height of all the scallops appearing both above and below the blanking band, measuring each scallop to the nearest 0.05 in (mm.). Write this total on the profile sheet near the left end of the scale together with a small mark to align the scale when moving to the next section. Short portions of the profile line may be visible outside the blanking band but unless they project 0.03 in. (0.5 mm) or more and extend longitudinally for 2 ft. (0.6 m) [0.08 in. (2 mm) on the profilogram] or more, they are not included in the count (see Figure 1 for illustration of these special conditions).

6.4 When scallops occurring in the first 0.1 mi. (100 m) are totaled, slide the scale to the left, aligning the right end of the scale with the small mark previously made, and proceed with the counting in the same manner. The final section of a placement will usually not be an exact 0.1 mi. (100 m). Except at the boundaries of excluded areas (bridges, project limits, etc.), do not include such short sections in the day's run. Instead, wait until the next placement is to be profiled, then begin profiling at the ending point of the previous complete 0.1 mi. (100 m) section. In this way, the profile record will consist entirely of 0.1 mi. (100 m) sections except at the boundaries of excluded areas. At these locations, treat the short sections as follows. If the length is less than 250 ft. (50 m), combine the count with the count for the adjoining full section, then multiply by the ratio of standard section length to combined length. If the length is 250 ft. (50 m) or more, multiply the count by the ratio of standard section length to short section length. In either case, after the multiplication, round the result to the nearest 0.05 in. (mm). Perform such rounding manually if the profilograph computer is not programmed to do so. See Section 10 for additional information on rounding. An example follows:

ENGLISH		
Section Length, miles	Counts, tenth of an inch	Profile Index
0.10	5.0	0.50 in./0.1 mi.
0.10	4.0	0.40 in./0.1 mi.
0.10	3.5	0.35 in./0.1 mi.
400 ft. = 0.076	2.0	0.2/0.76 = 0.26 in./0.1 mi. (Report as 0.25)

METRICS		
Section Length, meters	Counts, mm	Profile Index
100	6	6 mm/100 m
100	9	9 mm/100 m
100	8	8 mm/100 m
62	4	4/0.62 = 6.45 (Report as 6 mm/100 m)

7 Limits of Counts – Joints

7.1 When counting profiles, a day's paving is considered to include the last portion of the previous day's work, which includes the daily joint. The last 15 to 30 ft. (5 to 10 m) of a day's paving cannot usually be obtained until the following day. In general, the paving contractor is responsible for the smoothness of joints if he places the pavement on both sides of the joint. On the other hand, the contractor is responsible only for the pavement placed by him if the work abuts a bridge or a pavement placed under another contract. Profilograph readings when approaching such joints should be taken in conformance with current specifications.

PART III. DETERMINATION OF "MUST GRIND" HIGH POINTS

8 Equipment

8.1 Use a plastic template having a line 1 in. (26.7 mm) long scribed on one (1) face with a small hole or scribed mark at either end, and a slot or line 0.3 in. (8 mm) from and parallel to the scribed line (see Figure 2). The 1 in. (26.7 mm) line corresponds to a horizontal distance of 25 ft. (8 m) on the horizontal scale of the profilogram. The plastic template may be obtained from the Central Materials Lab.

9 Locating "Must Grind" High Points

9.1 At each prominent peak or high point on the profile trace (including the breaks in the profile trace at the beginning and end of any dip), place the template so that the small holes or scribe marks at each end of the scribed line intersect the profile trace to form a chord across the base of the peak or indicated bump. The line on the template need not be horizontal, and in the case of the entrance or exit of a profile dip, the line may depart significantly from horizontal. With a sharp pencil, draw a line using the narrow slot in the template as a guide. Any portion of the trace extending above this line will indicate the approximate length and height of the deviation in excess of 0.3 in. (8 mm). Applying the bump template at the entrance and exit of a dip is important because grinding at these locations is the only practical way to reduce the pavement roughness associated with the dip.

There may be instances where the distance between easily recognizable low points is less than the template length. In such cases, a shorter chord length shall be used in making the scribed line on the template tangent to the trace at the low points. It is the intent, however, of this requirement that the baseline for measuring the height of bumps will correspond as nearly to 25 ft. (8 m) as possible, but in no case is to exceed this value. When the distance between prominent low points is greater than the template length, make the ends of the scribed line intersect the profile trace when the template is in a nearly horizontal position, except at the entrance and exit of a profile dip as discussed above. A few examples of the procedure are shown in the lower portion of Figure 2.

PART IV. MISCELLANEOUS

10 Computer Equipped Profilers

10.1 Some profilograph models use an electronic computer to produce and evaluate the profilogram. Filtering is normally used to remove spikes, followed by automatic summation of roughness. It has been found, however, that certain types of spike filters remove short wavelength roughness features that should be included in the count. Current (approximately 1993 or later) models of Cox, Ames, and McCracken Profilographs use a spike (sometimes called low pass) filter developed by Michigan DOT that eliminates the problem mentioned in the previous sentence. Such profilographs are acceptable for use on ITD projects, provided a low pass filter setting of two (2) is used. Any high pass or long wavelength filter is to be turned off (some manufacturers use a setting of zero for this purpose). All other testing parameters given in this test method apply to computer-equipped profilographs, as well as manual models, and are to be entered by the operator as program constants.

10.2 If a computer-equipped profilograph other than those listed in 9.1 is proposed for use, the contractor shall furnish evidence satisfactory to the engineer that the unit produces results equivalent to a manually operated California Profilograph.

10.3 In case of any unresolvable dispute about the results from a computer-equipped profilograph, the referee method shall consist of a retest using a manually operated California Profilograph.

10.4 Calibration of the unit should be verified at the beginning of the project and as needed thereafter

11 Additional Discussion on Profiler Accuracy and Variability

11.1 Computerized profilographs generally are capable of reporting scallop height to some decimal fraction of the nearest 0.01 in. (mm). However, the representation of overall pavement roughness by a single run is always significantly less accurate than this, as discussed below.

11.2 Specifications call for measurement along a single line to represent the entire wheel path, which is about 3 ft. (1 m) wide. In some cases, the width represented is a full lane width, which is up to four (4) times the wheel path width. Testing has shown that the height of a bump or depth of a dip can easily vary by more than 0.05 in. (1 mm) across the wheel path, with even greater variation possible across the full lane.

11.3 Other sources of uncertainty also affect the accuracy with which a single run can represent the pavement surface. The pavement surface moves slightly during the day as heating and cooling take place. The calibration sometimes drifts during the course of a day by a small but detectable amount. Also, response characteristics of a profilograph may change slightly as its various mechanical and/or electrical components react to changes in ambient temperature. Such influences are probably smaller than the variability described in 10.2, but their effect is to increase overall variability of measurement.

11.4 In light of the discussion above, no real improvement in accuracy would result from recording the scallop heights any closer than 0.05 in. (the nearest mm). Doing so would give an incorrect impression as to the real accuracy of overall representation.

11.5 Pay factor tables in the contract may include limits stated as decimal fractions of a 0.01 in. (mm). This is only done so that the profile index cannot fall on the boundary, but will always be on one side or the other. Stating the limits in this way does not imply that it is appropriate to record profilograph scallops in increments less than 0.05 in. (1 mm). For example, a given pay factor range might be 0.26 to 0.34 in./0.10 mi. (4.1 to 5.3 mm/100 m). Thus, a result of 0.30 in./0.10 mi. (5 mm/100 m) would be the only test result that would fall within the stated range.

EXAMPLE SHOWING METHOD OF DERIVING PROFILE INDEX FROM PROFILOGRAMS

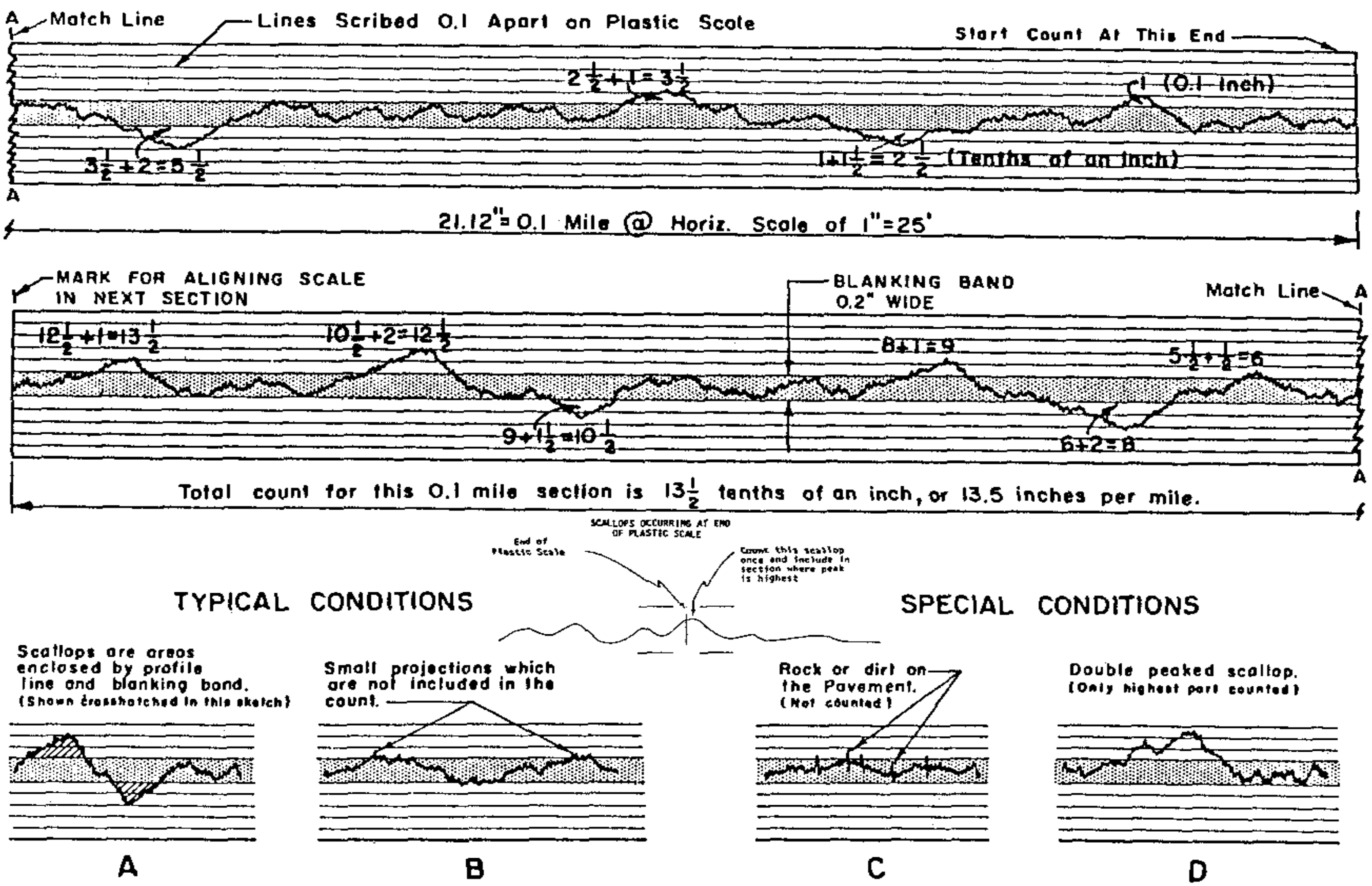
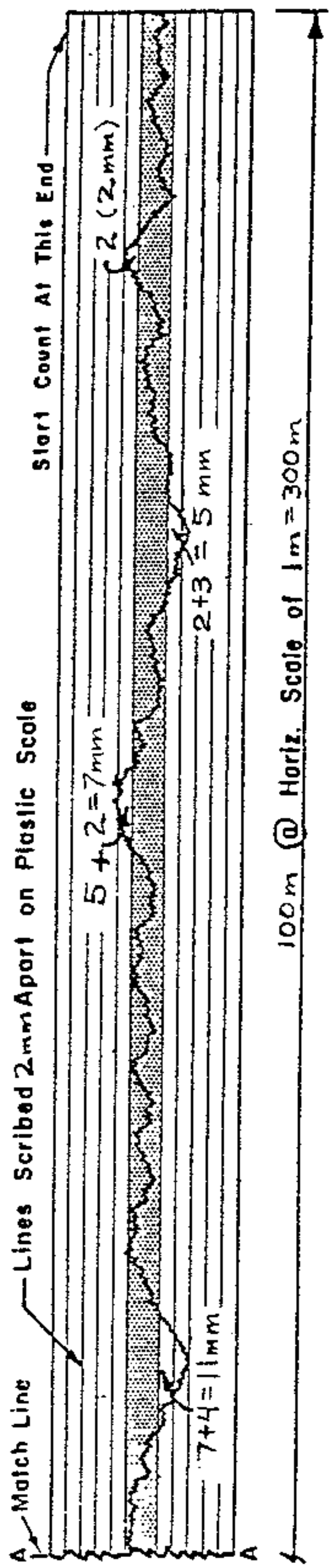


FIGURE I

EXAMPLE SHOWING METHOD OF DERIVING PROFILE INDEX FROM PROFILOGRAMS



Total count for this 100m section is 12 mm, or 12 mm/100m

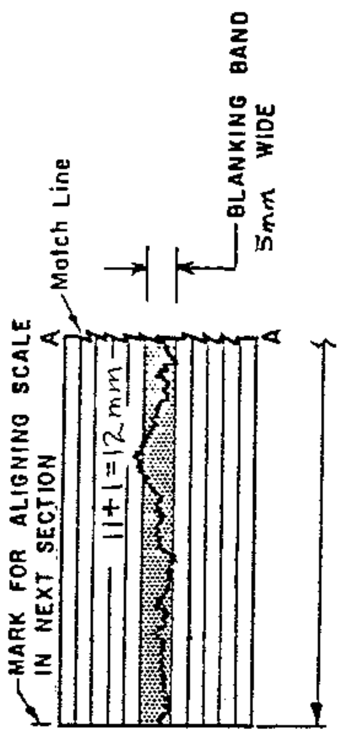


FIGURE I M

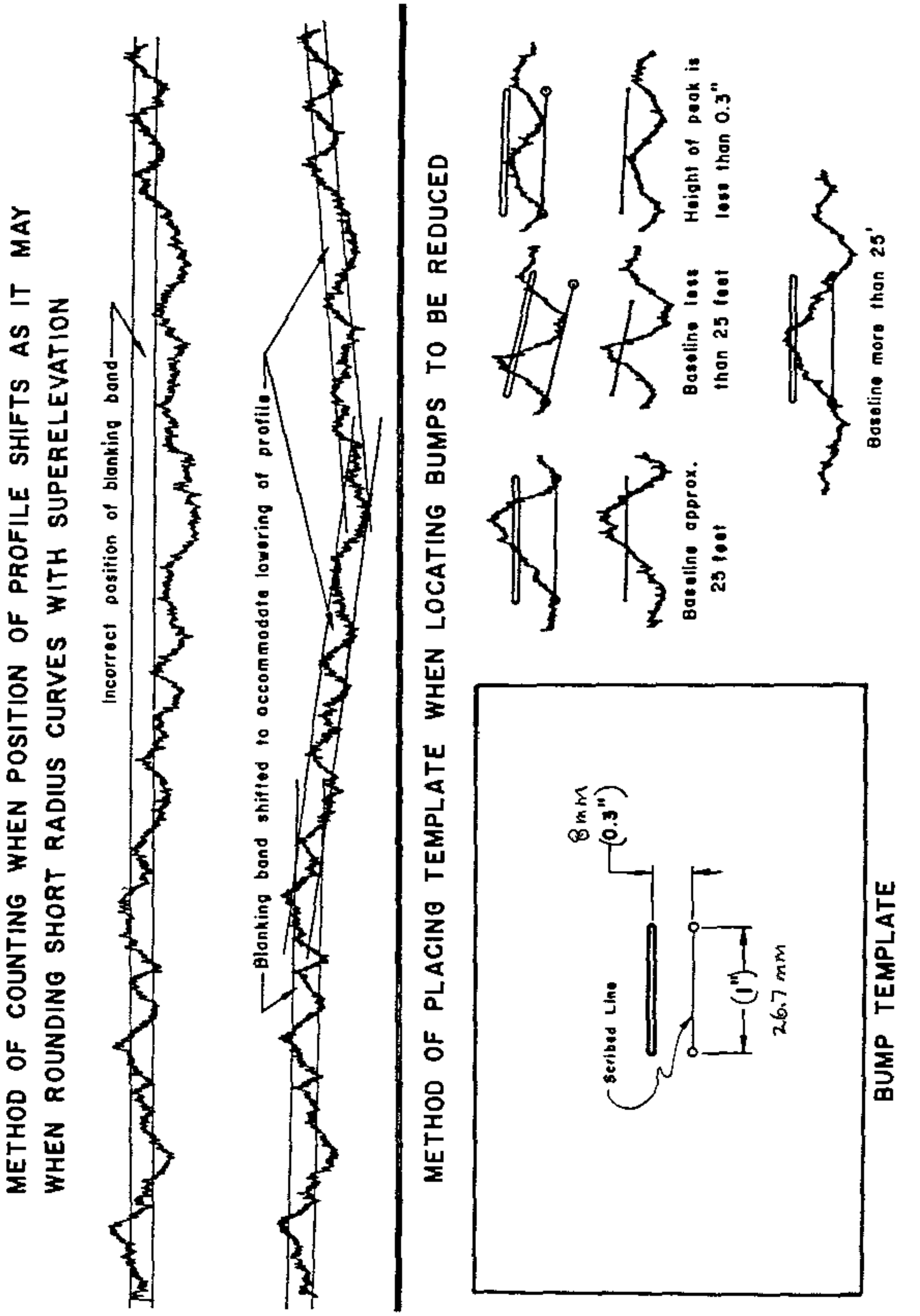

METHOD OF COUNTING WHEN POSITION OF PROFILE SHIFTS AS IT MAY
WHEN ROUNDING SHORT RADIUS CURVES WITH SUPERELEVATION
Incorrect position of blanking band
Blanking band shifted to accommodate lowering of profile
METHOD OF PLACING TEMPLATE WHEN LOCATING BUMPS TO BE REDUCED
Baseline approx. 25 feet
Baseline less than 25 feet
Height of peak is less than 0.3"
Baseline more than 25'
Scribed Line
8mm
(0.3")
(1")
26.7 mm
BUMP TEMPLATE

FIGURE 2

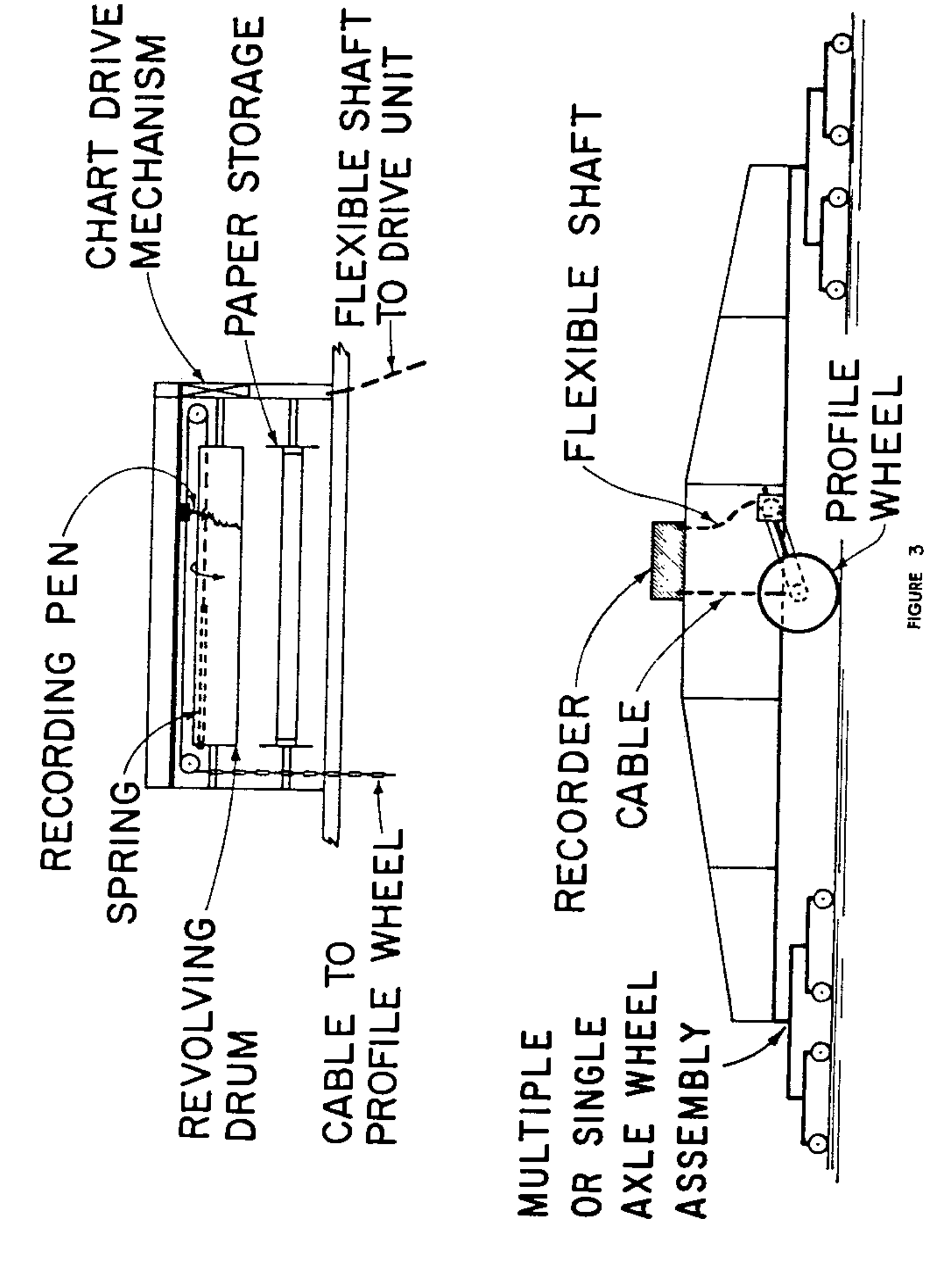


CHART DRIVE MECHANISM
PAPER STORAGE
FLEXIBLE SHAFT TO DRIVE UNIT
RECORDING PEN
SPRING
REVOLVING DRUM
CABLE TO PROFILE WHEEL
FLEXIBLE SHAFT
RECORDER
CABLE
PROFILE WHEEL
MULTIPLE OR SINGLE AXLE WHEEL ASSEMBLY

FIGURE 3

ITD-880 8-98 W

PROFILOGRAPH SUMMARY

IDAHO T-140

Sheet ______ of ______

Roll No. ____________

For Information Only ☐ Preliminary ☐ Intermediate ☐ Final ☐

Key No. ____________ Project No. ______________________________

Location ____

Contractor ______________________________ Date Paved ________

Tested By ______________________________ Date ________

Trace Reduced By ______________________________ Date ________

Comments ____

NB ☐ EB ☐ WB ☐ SB ☐

Inside Lane	☐	Inside Lane	☐
Outside Lane	☐	Outside Lane	☐
Center Line	☐	Center Line	☐
1 m (3') from Outside Edge	☐	1 m (3') from Outside Edge	☐
1 m (3') from Inside Edge	☐	1 m (3') from Inside Edge	☐

PROFILE INDEX mm/100 m (in./0.1 mi.)	MEASURED ROUGHNESS mm (inches)	LENGTH m (miles)	LOCATION (Station)	LENGTH m (miles)	MEASURED ROUGHNESS mm (inches)	PROFILE INDEX mm/100 m (in./0.1 mi.)

STATION ◄—— 8 mm (.3 inch) Bump Location ——► STATION

Idaho Standard Practice for

Design of Seal Coats and Single Surface Treatments by the McLeod Method

Idaho IR-63-13

1. Scope

In the late 1960's Norman McLeod (1969) presented the following design method which was later adapted by the Asphalt Institute (1979, 1983) and the Asphalt Emulsion Manufacturers Association (1981). In this method, the aggregate application rate depends on the aggregate gradation, shape, and specific gravity. The binder application rate depends on the aggregate gradation, absorption and shape, traffic volume, existing pavement condition, and the residual asphalt content of the binder. It should be noted that this method was developed primarily for use with emulsion binders and has not been verified in Idaho.

The McLeod method is based on two basic principles:

1.	The application rate of a given aggregate should be determined such that the resulting seal coat will be one-stone thick. This amount of aggregate will remain constant, regardless of the binder type or pavement condition.
2.	The voids in the aggregate layer need to be 70 percent filled with asphalt for good performance on pavements with moderate levels of traffic.

2. Design Procedure Components

2.1 Median Particle Size. The Median Particle Size (M) is determined from the aggregate gradation chart. It is the theoretical sieve size through which 50 percent of the material passes. The following sieve sizes should be used:

Sieve Sizes
1 inch
¾ inch
½ inch
Inch
¼ inch
No. 4
No. 8

No. 16
No. 50
No. 200

2.2 Flakiness Index. The flakiness index (F) is a measure of the percent, by weight, of flat particles. It is determined by testing a sample of the aggregate particles for their ability to fit through a slotted plate (Idaho IR-64-09).

2.3 Average Least Dimension. The Average Least Dimension, or ALD (H), is determined from the Median Particle Size and the Flakiness Index. It is a reduction of the Median Particle Size after accounting for flat particles. It represents the expected seal coat thickness in the wheel paths where traffic forces the aggregate particles to lie on their fattest side. The ALD is calculated as follows:

Equation 63-1 $H=M / [1.139285 + (0.011506) FI]$

Where:
H = Average Least Dimension, inches
M = Median Particle Size, inches
FI = Flakiness Index, percent

2.4 Loose Unit Weight of the Cover Aggregate. The dry loose unit weight (W) is determined according to AASHTO T-19 and is needed to calculate the voids in the aggregate in a loose condition. The loose unit weight is used to calculate the air voids expected between the stones after initial rolling. It depends on the gradation, shape, and specific gravity of the aggregate.

2.5 Voids in the Loose Aggregate. The voids in the loose aggregate (V) approximate the voids present when the stones are dropped from the spreader onto the pavement. Generally, this value will be near 50 percent for one size of aggregate, less for graded aggregate. After initial rolling, the voids are assumed to be reduced to 30 percent and will reach a low of about 20 percent after sufficient traffic has oriented the stones on their fattest side. However, if there is very little traffic, the voids will remain 30 percent, and the seal will require more binder to ensure good aggregate retention. The following equation is used to calculate the voids in the loose aggregate:

Equation 63-2 $V = 1 – W/ (62.4G)$

Where:
V = Voids in the loose aggregate, in percent expressed as a decimal
W = Loose unit weight of the cover aggregate, lbs/ft^3
G = Bulk specific gravity of the aggregate (AASHTO T 19).

2.6 Aggregate Absorption. Most aggregates absorb some of the binder applied to the roadway. The design procedure should be able to correct for this condition to ensure enough binder will remain on the pavement surface. McLeod suggests an absorption correction factor, A or 0.02 gal/SY if the aggregate absorption is around 2 percent (as determined from AASHTO T-84). In the Minnesota Seal Coat Handbook, it is recommended that a correction factor of 2 percent be used if the absorption is 1.5 percent or higher.

2.7 Traffic Volume. The traffic volume, in terms of vehicles per day, plays a role in determining the amount of asphalt binder needed to sufficiently embed the aggregate. Typically, the higher the traffic volume, the lower the binder application rate. At first glance, this may not seem correct. However, remember that traffic forces the aggregate particles to lie on their flattest side. If a roadway had no traffic, the particles would be lying in the same orientation as when they were first rolled during construction. As a result, they would stand taller and need more asphalt binder to achieve the ultimate 70 percent embedment. With enough traffic, the aggregate particles will be laying as flat as possible causing the seal coat to be as thin as possible. If this is not taken into account, the wheelpaths will likely bleed. The McLeod procedure uses Table 63-1 to estimate the required embedment, based on the number of vehicles per day on the roadway.

Table 63-1, Traffic Correction Factor, T				
Traffic Factor*				
Traffic – Vehicles per day				
Under 100	100 to 500	500 to 1000	1000 to 2000	Over 2000
0.85	0.75	0.70	0.65	0.60
*The percentage, expressed as a decimal, of the ultimate 20 percent void space in the aggregate to be filled with asphalt.				

Note: The factors above do not make allowance for absorption by the road surface or by absorptive aggregate.

2.8 Traffic Whip-Off. The McLeod method also recognizes that some of the aggregate will get thrown to the side of the roadway by passing vehicles as the seal coat is curing. This loss is related to the speed and number of vehicles on the new seal coat. To account for this, a traffic whip-off factor (E) is included in the aggregate design equation. A reasonable value is to assume 5 percent for low volume, residential type and 10 percent for higher speed roadways. The traffic whip-off factor is shown in Table 63-2.

Table 63-2. Aggregate Wastage Factor, E*	
Percentage Waste Allowed for Traffic Whip-Off and Handling	**Wastage Factor, E**
1	1.01
2	1.02
3	1.03
4	1.04

5	1.05
6	1.06
7	1.07
8	1.08
9	1.09
10	1.10
11	1.11
12	1.12
13	1.13
14	1.14
15	1.15
*(Source: Asphalt Institute MS-19, March 1979).	

2.9 Existing Pavement Condition. The condition of the existing pavement plays a major role in the amount of binder required to obtain proper embedment. A new smooth pavement with low air voids will not absorb much of the binder applied to it. Conversely, a dry porous and pocked pavement surface can absorb much of the applied binder. Failure to recognize when to increase of decrease binder application rate to account for the pavement condition can lead to excessive stone loss or bleeding. The McLeod method uses the descriptions and factors in Table 63-3 to add or reduce the amount of binder to apply in the field.

Table 63-3, Surface Correction Factor, S.	
Existing Pavement Texture	**Correction, S**
Black, flushed asphalt surface	-0.01 to 0.06
Smooth, nonporous surface	0.00
Slightly porous, oxidized surface	+ 0.03
Slightly pocked, porous, oxidized surface	+ 0.06
Badly pocked, porous, oxidized surface	+0.09

These surface conditions may vary throughout the project, and adjustments should be made accordingly.

3. McLeod Seal Coat Design Equations

The following equations are used to determine the aggregate and binder application rates. While the results may need adjustment in the field, especially the binder application rate, they have been shown to provide a close approximation of the correct material quantities.

3.1 Aggregate Design Equation. The aggregate application rate is determined from the following equation:

Equation 63-3 $C = 46.8\ (1 - 0.4V)\ HGE$

Where:
C = Aggregate application rate, lbs/SY
V = Voids in the loose aggregate, in percent expressed as a decimal (Eq. 63-2)
H = Average least dimension, inches
G = Bulk specific gravity of the aggregate
E = Wastage factor for traffic whip-off (Table 63-2)

3.2 Binder Design Equation. The binder application rate is determined as follows:

Equation 63-4 $B = (2.244HTV + S + A) / R$

Where:
B = Binder application rate, gal/SY
H = Average least dimension, inches
T = Traffic Correction Factor (based on vehicles per day, Table 63-1)
V = Voids in loose aggregate, percent expressed as decimal (Eq. 63-2)
S = Surface condition factor, gal/SY (based on existing surface, Table 63-3)
A = Aggregate absorption factor, gal/SY
R = Percent residual asphalt in the emulsion expressed as a decimal. Check with supplier to determine percent residual asphalt content of emulsion. For asphalt cement, R = 1.